THE le@rning FEDERATION

schools online curriculum content initiative

National Catholic Education Commission

TRIAL OF THE LE@RNING FEDERATION CONTENT DISTRIBUTION AND IMPLEMENTATION OF THE BASIC E-LEARNING TOOL SET (BELTS)

Report of trials conducted with the National Catholic Education Commission

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Reports summarising the trials conducted in schools were prepared by the following officers:

- Mr Michael Haigh: Canberra/Goulburn Archdiocese
- Ms Angela Forgan, Ms Ann Thornton and Mr Paul Barry: Melbourne Archdiocese
- Ms Fran Murray: Darwin Diocese
- Dr Kathryn Moyle on behalf of the Le@rning Federation
- Mr Adrian Brown: National Catholic Education Commission.

The collation of these respective trial reports into one consolidated report was undertaken by Dr Kathryn Moyle on behalf of The Le@rning Federation.

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Contents

1 EXECUTIVE SUMMARY 1

2 FINDINGS AND RECOMMENDATIONS 3

2.1 Teaching and learning 3
2.2 Management and administration 3
2.3 Technical 4
2.4 Support and self-help 4
2.5 Expertise 5
2.6 Culture 6
2.7 Costs and benefits of distribution models 6
2.8 Conclusion 8

3 BACKGROUND 9

3.1 Scope of the report 9
3.2 Purpose of the trial 9
3.3 Data collection 10
3.4 The Le@rning Federation 10
3.5 National Catholic Education Commission 10
3.6 Basic E -Learning Tool Set (BELTS) 11
3.7 Teacher and student computer software requirements 12
3.8 Learning object size 13

4 DESCRIPTION OF THE TRIALS 14

4.1 Models used to trial BELTS 14
4.2 Method of data collection 14
4.3 Settings for the trials 15
4.4 Support made available to the trial schools 17

5 OUTCOMES FROM THE TRIALS 18

5.1 Complexity of the trial environments 18
5.2 Addressing the purposes of the trial 21
5.3 National level 28

6 CONCLUSION 30

7 REFLECTIONS 31

8 REFERENCES 32

9 APPENDIX ONE 33
Report on the trial of Basic E-Learning Tool Set across the Central Schools in the Western Region (Canberra/Goulburn)

10 APPENDIX TWO: 59
Report on The Le@rning Federation trial (Melbourne)

10.1 APPENDIX TWO A 76
10.2 APPENDIX TWO B 78
10.3 APPENDIX TWO C: 81
10.4 APPENDIX TWO D: 84

11 APPENDIX THREE: 88
Computer and bandwidth configurations used in the Melbourne trial.

12 APPENDIX FOUR 92
National Catholic Education Commission BELTS deployment and distribution chain.

13 APPENDIX FIVE 95
Description of all schools used in the trial.

14 APPENDIX SIX 98
Bandwidth and IT configurations for all schools involved in the trial.

15 APPENDIX SEVEN 103
BELTS teacher user manual developed by the Melbourne Archdiocese for the trial

1 EXECUTIVE SUMMARY

1 In August 2003 the National Catholic Education Commission and The Le@rning Federation trial of distribution models for The Le@rning Federation learning objects commenced. The trials were conducted in 15 Catholic schools within the following three regions:

- Canberra/Goulburn Archdiocese
- Melbourne Archdiocese
- Darwin Diocese.

2 The key purpose of the trial was to assist The Le@rning Federation stakeholders' understand delivery requirements of TLF content to schools.

3 The following four models of distribution of The Le@rning Federation learning objects were trialed.

- A distributed delivery model was used in the Canberra/Goulburn Archdiocese with BELTS (Basic E-Learning Tool Set)[1] installed on the Catholic Education Office server located in Canberra and then replicated on four individual schools' servers located in New South Wales.
- Two centralised delivery models were trialed concurrently in the Melbourne Archdiocese. Schools accessed learning objects:
  - using BELTS via a server located in the office of the Catholic Education Commission Melbourne; and
  - using the online learning environment provided by the Application Service Provider (ASP) myinternet Ltd.
- A distributed delivery of the learning objects was undertaken with four remote schools in the Northern Territory using CD-ROMs.

4 A rich set of findings has been identified from the trials. This report outlines these findings. While this report focuses primarily on the outcomes from the BELTS trials, the findings are also relevant to those schools and jurisdictions that are accessing The Le@rning Federation learning objects without using BELTS.

5 Key findings that emerged from the trials included the following:

- Of the four models trialed, no distribution model emerged as more preferable than any other, but rather the mode of distribution was dependent upon the jurisdiction and school infrastructure and expertise. Three central considerations impinging on decisions about the preferred distribution model are bandwidth and cost of downloads; caching capabilities at the school level; and server load.
- Jurisdictions and school administrations required access to technical expertise while teachers needed user support. The nature of the support depended on the issue and ranged from help desk support to asynchronous email and self-help documentation.

[1] BELTS has been developed by TLF to provide:
1 early delivery of learning objects to education systems and sectors;
2 a prototype for an enterprise system architecture for provision of learning to the education systems and sectors to assist with developing their own architectures;
3 a framework for an open-source learning management system, allowing the initial solution to continue being extended for the benefit of education systems and sectors; and
4 a system that assists education systems and sectors and schools to identify their requirements for learning management systems.

- Further research is required into the total cost of ownership of the respective distribution models.
- Active engagement with the collaborative nature of open-source software communities was not obvious in these trials. Such engagement could enable both schools and jurisdictions to make further gains from using this software, particularly in relation to ongoing technical skill development and support, and with further local enhancements of BELTS. Awareness raising and explicitly stated protocols about how jurisdictions and individuals can participate and contribute to BELTS developments are required.

6 The trials highlighted the importance for schools and jurisdictions deploying BELTS to have administration and management strategies in place for updating learning objects and for identification and reuse by teachers of the sequences of learning they create, save and hold on servers.

7 It became clear that plugins are central to the ease of use and appropriate functioning of the learning objects. It is not known how many upgrades to plugins or to operating systems will occur during the lifetime of the content, but there are implications for both The Le@rning Federation and schools concerning plugins and software upgrades:

- Backwards compatibility is required with upgrades and new software to ensure that all learning objects can be accessed and used.
- Ongoing liaison with the major vendors by The Le@rning Federation will be required to promote backward compatibility.

8 Schools require management strategies to ensure that, before students use computers to access the learning objects, the computers are set up with the appropriate configuration of software, including plugins, to ensure access and ease of use of the learning objects.

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2 FINDINGS AND RECOMMENDATIONS

In this summary of the findings emerging from the trial, the outcomes are presented in seven categories: teaching and learning, management and administration, technical, support and self-help, expertise, culture, and costs and benefits of different distribution models. Recommendations for each category have been included for the Exchange Consultative Committee to consider for future development of BELTS and for other collaborations over implementation issues.

2.1 Teaching and learning[2]

- It took between a half and a full day of professional development for teachers to learn how to use BELTS and to create a sequence of learning or a lesson that incorporated learning objects.
- Teachers indicated that they liked BELTS and the learning objects trialed, and could see the potential for their further use in their teaching and learning.
- Once teachers were able to use BELTS they tended to look for further functionality such as the ability to:
    - 're-skin' the look and feel of BELTS according to the age levels of their students;
    - vary the font sizes;
    - incorporate learning objects from other sources;
    - incorporate school logos and other 'branding' information about the school; and
    - easily share and compare with others, sequences of learning.

2.1.1 Recommendations

- That jurisdictions are encouraged to develop portfolios of case studies showing good practice by teachers and students using BELTS, and that these are shared nationally.
- That the ECC consider recommending that BELTS is further developed to provide additional functionality that allows users to:
    - 're-skin' the look and feel of BELTS according to the age levels of their students;
    - vary the font sizes;
    - incorporate learning objects from other sources;
    - incorporate school logos and other 'branding' information about the school; and
    - easily share and compare with others, sequences of learning.

2.2 Management and administration

- To ensure ease of use of the software it is essential to prepare servers and computers according to the specifications identified by The Le@rning Federation prior to the use of BELTS and learning objects. For instance: appropriate editions of plugins and browsers were shown to be central to the successful use of BELTS and learning objects.

[2] Although outside the gamut of the trial, during the classroom observations of the use of BELTS and learning objects it became apparent that due to the importance of sound in learning objects, that the use of headphones or other sound management strategies would be required when more than a few students were using the learning objects at any one time.

- Both teachers and technical administrators identified that functionality in BELTS should be enhanced to allow single entry of student data for sequences of learning to enable sharing across schools and across a jurisdiction.
- To enable collaboration and sharing of content within and between schools using BELTS, protocols should be established for naming or identification of sequences of learning.
- Automating the download of learning objects from the Exchange into BELTS and from BELTS to other BELTS would streamline the 'distributed' model.

2.2.1 Recommendations

- That learning object metadata clearly specifies the version of the plugin software required for optimum performance.
- That the BELTS interface indicates the version number of the BELTS release.
- That the ECC consider recommending that BELTS is enhanced to allow single entry of student data for sequences of learning to enable sharing across schools and across a jurisdiction.
- That examples of the sorts of protocols for naming and identifying sequences of learning that could be used in schools are developed.
- That the ECC consider recommending that BELTS is enhanced to automate the download of learning objects from the Exchange into BELTS and from BELTS to other BELTS servers.

2.3 Technical

- Both distributed and central delivery models using BELTS worked well with small server loads.[3]
- There was equivalence in the time taken to deliver the learning objects to the desktop using either an ASP or BELTS.
- The provision of caching facilities emerged as central to the efficient use and reuse of learning objects in the classroom.
- BELTS was trialed with some success on servers and computers using hardware and operating system specifications below those identified by The Le@rning Federation, but the specified plugins were a key to achieving successful use of the learning objects within BELTS.
- Upgrades and releases of software (eg Macromedia and Microsoft) during the course of the trials raised concerns over backward compatibility (ie compatibility with earlier versions of software), in particular with browser plugin software.

2.3.1 Recommendations

- That further analysis of caching requirements of learning objects is undertaken.
- That server loads are further analysed.
- That The Le@rning Federation undertakes ongoing liaison with the major vendors to promote backward compatibility of software.

2.4 Support and self-help

- Support for schools through the provision of external technical advice and self-help documentation appropriate to all those using BELTS (ie technical, teacher, jurisdiction support) emerged as important tools for the successful use of BELTS.

[3] Small loads refers to less than 20 schools or less than 100 users.

- During the course of the trials, The Le@rning Federation developed technical documentation and teacher and student support materials on BELTS. More needs to be done to ensure users know that this documentation is available on The Le@rning Federation and sourceforge websites.[4]
- Users expressed frustration when reading the BELTS technical support documentation for the first time. However, they found that subsequent readings were easier.
- Different forms of support are needed for users who receive learning objects on CD-ROM and do not have access to the Internet.
- A diagnostic tool that can automatically quiz the user's computer to check whether it is configured correctly to access and use the learning objects was identified as a useful development that could emerge as a result of the trials.[5]

2.4.1 Recommendations

- That simple one-page self-contained 'client' and 'server' configuration charts are developed to ensure that the computers used to access learning objects are appropriately configured prior to use of the learning objects[6].
- That the range of BELTS' trials being undertaken across jurisdictions are monitored by the ECC to:
  - document learning achieved through the repetitions of installation and upgrading processes; and
  - ascertain whether subsequent installations of BELTS attract the same or lower levels of difficulty and therefore expertise.
- That small focused trials of the BELTS technical documentation, and of the teachers' and students' handbooks (see http://belts.sourceforge.net/teacher/index.html), are undertaken.
- That publicity and awareness raising about the location of the BELTS handbooks and technical documentation is conducted with jurisdictions to support their professional development of teachers using BELTS.
- That all relevant BELTS documentation and support documents are consolidated and housed publicly on the BELTS site (http://belts.sourceforge.net).
- That software is developed that will automatically check whether the 'client's computer' is configured correctly to access and use learning objects.[7]
- That the CD-ROMs developed for use in remote schools include an installation tutorial and a print instruction manual on how to use the CD-ROM and learning objects.
- A 'Frequently asked questions' or 'Helpful hints to troubleshooting BELTS' page be maintained over time on the BELTS site (http://belts.sourceforge.net).

2.5 Expertise

- It was found that relatively low expertise in open-source software and Linux was needed for an 'auto install' of BELTS when the installation ran smoothly.
- However, when installations of BELTS did not run smoothly, troubleshooting was complex as it required considerable analysis of the range of software tools interacting with each other.

[4] http://www.thelearningfederation.edu.au and http://belts.sourceforge.net.
[5] The Le@rning Federation has begun developing such a diagnostic tool as a result of this trial.
[6] These charts should not include jumps to several URLs to check configuration requirements.
[7] Work on this recommendation has already been commenced by The Le@rning Federation.

- This troubleshooting also required high-level technical expertise in open-source software, particularly Linux.
- For the troubleshooting, external help via phone calls, emails and access to information via websites was necessary.
- Accessing learning objects via CD-ROM was problematic and demonstrated that a simpler menu structure, with the required plugins already included, was required.

2.5.1 Recommendations

- That a pool of national expertise in installing, maintaining and troubleshooting issues arising from the use of BELTS is established online, and individuals within the pool of experts are accessible via email and listservs.
- That jurisdictions through the ECC consider providing nationally consistent training, at regular intervals between 2004 and 2006, for technical administrators and help desk support in how to install, maintain and troubleshoot within BELTS.
- That small widespread trials of the BELTS installation disk developed by officers in the Canberra/Goulburn Catholic Education Office are conducted to establish whether the installation disk could be widely used nationally as an easy installation method.
- That the ECC consider developing CD-ROMs (or possibly DVDs) with a simple menu structure, the required plugins and a help tutorial for use in remote schools.

2.6 Culture

- The underpinning philosophy and culture of collaborative open-source developments and their potential for providing support to projects such as BELTS does not seem to have been broadly understood to date.
- BELTS tends to be seen more as a product rather than as an open-source process, for which ongoing development and refinement are activities to which the jurisdictions can actively contribute.
- Engagement with the collaborative nature of open-source software communities was not obvious at the school level in the trials. Such engagement would increase the benefit from using this software for both schools and jurisdictions, particularly in relation to ongoing technical skill development and support, and with further local enhancements of BELTS.

2.6.1 Recommendation

- That awareness-raising activities and explicitly stated protocols about how jurisdictions and individuals can participate and contribute to BELTS developments are developed.

2.7 Costs and benefits of distribution models

No conclusive evidence emerged to indicate that one distribution model was better than any other. Rather, pros and cons were identified for each of the different models trialed.

2.7.1 The pros and cons[8]

2.7.1.1 Centralised BELTS server

Pros

- There is only one place to access the learning objects. This alleviates potential confusion and issues that may occur when new versions of the learning objects are released from the Exchange.

[8] The following information has been derived from the Canberra/Goulburn report prepared by Mr Michael Haig. For more information about the pros and cons of different models see Appendix One.

- Only one server manages all aspects of the distribution process.
- Lessons can be shared easily with other users on the network.
- Professional development can be delivered from the central box.

Cons

- Management practices are required to handle naming for lessons and users.
- There is the potential for server performance to degrade under loads (eg more than 20 schools).
- If the central server goes down then all schools are affected.
- Objects need to be cached at the local school level to improve learning object performance.

2.7.1.2 Distributed BELTS servers

Pros

- Lessons and objects are available on the Local Area Network (LAN).
- Lesson naming is critical only on the LAN.
- Caching is less critical than the server for deploying the objects locally.
- If the server goes down only the local school goes out.
- The server can handle multiple functions, including BELTS (eg caching, firewall).

Cons

- Management practices are required to handle the download and distribution of objects at both the central and local levels.
- Many servers are required.
- Each of the dependent systems requires its own management.
- Upgrades need to be applied to each server.

2.7.1.3 ASP[9]

Pros

- All management responsibility for the regular downloads of learning objects from the Exchange and distribution to local sites is delegated to the ASP.
- Costs of downloads, upgrades and maintenance of software (for example) are included in the online environment and are packaged into a single cost.
- It is the responsibility of the ASP to resolve issues as they arise, according to the contract and the agreed specifications.
- All users work in the same online learning environment.
- Technical expertise is the responsibility of the ASP.

Cons

- If the ASP's servers go down then all schools go out.
- Using the online learning environment provided through the ASP requires professional development in addition to that for using BELTS.
- Specific management practices are required to handle naming for lessons and users.

[9] It should be noted that the goods and services included in a contract with an ASP depends on the negotiations between the customer and the vendor, and could therefore vary between jurisdictions – depending on the contract.

- Managing the licences and monitoring the contract to ensure that the goods and services purchased are delivered must be undertaken by the customer.
- Jurisdictions pay both for the ASP's online learning environment and for BELTS through their contribution to The Le@rning Federation.

Delivery models

The trial in the Melbourne Archdiocese found little difference in the speed or quality of the delivery of learning objects accessed using BELTS and myinternet. A difference emerged however in relation to the payment of download costs.

The myinternet server is housed within the Catholic Education Office Melbourne virtual private network (VPN). The myinternet trial schools did not pay for download costs, regardless of the number of times they use the TLF learning objects, because they were accessing the content from within the VPN. However, those schools accessing content via BELTS, which was not located within the VPN, were charged download costs based on the frequency of use of the learning objects. The location of the learning object repository within or outside of the VPN will impact on the cost of delivery and use of objects at the school level.

Hence, total cost of ownership should include the cost of accessing, managing and downloading the learning objects.

2.7.1.4 CD-ROMs

Pros

- Access to learning objects does not depend on access to the Internet.
- Use and reuse of the learning objects does not involve download costs or bandwidth.
- Access to learning objects should be rapid.
- Management practices are not required to handle naming for multiple users and their lessons unless the school is using a LAN.

Cons

- Managing different versions of CDs will be necessary as new learning objects are released or when old learning objects are updated.
- As the pool of learning objects grows, it is likely that several CDs will be required or, alternatively, DVDs will be needed for storage, but it is not known how many remote schools have access to DVD players.
- Plugins must be installed on computers without access to the Internet.
- Sharing lessons between teachers can occur only via a LAN, through sharing the same computer or by hardcopy.

2.7.2 Recommendations

- The questions of 'how will BELTS be integrated with a learning management system and what are the additional costs, management and professional development this brings?' be analysed using a total cost of ownership approach and the results considered by ECC later in 2004.
- Ongoing monitoring of total cost of ownership for delivery solutions across jurisdictions will be communicated through ECC during 2004–2006.

2.8 Conclusion

The choice of the most appropriate distribution model for delivering The Le@rning Federation content to schools depends on infrastructure, on the deployment of technical expertise and on available support such as documentation. This decision requires a review of the total cost of ownership for the preferred model, and the outcome may be a combination of models to meet the specific local requirements of schools and jurisdictions.

3 BACKGROUND

3.1 Scope of the report

This report summarises the outcomes from the *Trial of The Le@rning Federation content distribution and implementation of the Basic E Learning Tool Set (BELTS)*. Data for this report was gathered through in-school trials conducted between August and November 2003. The trials were conducted with the National Catholic Education Commission in 15 Catholic schools in two Archdioceses and one Diocese located in two states and one territory. Contextually, each of the Archdioceses and the Diocese are different, and different models of deploying BELTS and different distribution models were trialed across these locations.

The Le@rning Federation provided advice and technical support to the regionally based officers located in three Catholic Education Commission offices. These officers supported the schools involved in the trials and prepared reports of the outcomes from their component of the overall project. These case studies form the basis of this report and each contributes a different perspective to the outcomes from the trials. These three case study reports are included in full in Appendices One, Two and Three.

3.2 Purpose of the trial[10]

The key purpose of the trial was to assist The Le@rning Federation stakeholders' understand the delivery requirements of The Le@rning Federation content to schools. The trials were designed to focus on the following issues:

- What level of technical support staff at school and system level is needed?
- What sort of training at school and system level is required of this staff?
- What is the length of time needed for setting up, supporting and maintaining BELTS?
- What are the issues in installing the box onto a network?
- What are the expectations for download times and bandwidth?
- What are the implications of the actual download time?
- How do the learning objects behave when delivered to schools (ie are there any implementation issues with the learning objects)?
- What are the expected and required professional development needs at a school and system level?
- What technical skills do teachers need to make effective use of BELTS?
- What skills and learning and teaching strategies do teachers need to integrate the learning objects into the curriculum?
- How will BELTS be integrated with a learning management system and what are the additional costs, management and professional development this brings?[11]

The trials were also to attempt describing the costs and benefits of the issues associated with the models of deployment used. Outcomes of the trial are intended to benefit all stakeholders and The Le@rning Federation.[12]

[10] This outline of the purposes of the trial is extracted from the *Submission on behalf of the National Catholic Education Commission(2003) for Funding Support to Trial the Implementation of the Basic E-learning Tool Set (BELTS) System* sent to The Le@rning Federation.
[11] *Ibid*
[12] Ibid.

3.3 Data collection

Data for this report was generated through:

- documentation provided by officers in the:
  - National Catholic Education Commission office
  - Archdiocese of Canberra/Goulburn
  - Archdiocese of Melbourne
  - Diocese of Darwin
- existing documentation about BELTS generated by The Le@rning Federation;
- school and Catholic Education Commission office site visits and observations;
- weekly teleconferences conducted throughout the course of the project; and
- discussions with members of the ISD team at The Le@rning Federation who managed the development of BELTS.

3.4 The Le@rning Federation[13]

The Le@rning Federation is an initiative of state and federal governments of Australia and New Zealand. The Le@rning Federation aims to procure high quality researched and evaluated online curriculum content for delivery to system gateways in Australia (including Australian states and territories) and New Zealand. The initiative is being achieved through a collaborative coordinated program, reducing potential duplication and increasing cost efficiencies, while stimulating the market and private investment in development.

The Le@rning Federation has adopted a design methodology for creating online content in the form of learning objects – chunks of material that can be used and reused for a variety of educational purposes. Between 2001 and 2006 The Le@rning Federation is developing the online curriculum content, which is being housed in a central repository (the Exchange), and is delivered to jurisdictions[14] via the Basic E-Learning Tool Set (BELTS).

The Basic E-Learning Tool Set (BELTS) is an open-source[15] enterprise java solution that has been designed to support the presentation and management of learning objects to students. BELTS has not been designed as a fully featured learning management system. BELTS was designed so that it would be a component in a larger infrastructure framework.[16]

3.5 National Catholic Education Commission

The National Catholic Education Commission is a national system of Catholic schools. As a national jurisdiction it provides a context within which collaborative national efforts such as BELTS can be trialed. It is against the abovementioned background of the identified technical requirements to implement BELTS that the trials were conducted.

[13] The following information about The Le@rning Federation has been drawn from The Le@rning Federation (2003b) and The Le@rning Federation (2002c).
[14] The term 'jurisdiction' is the collective term used to refer to government and non-government school systems and sectors.
[15] Open -source software uses software source code that is open, unrestricted and available by downloading it from the Internet. The Le@rning Federation has identified a number of advantages to this form of licensing, including widespread use and feedback on functionality, reuse of code by other projects, and integration with other tool sets. The BELTS application has been made available at sourceforge (http://sourceforge.net/projects/belts), a major portal for the open-source community. See The Le@rning Federation (2003d).
[16] See Section 2.2 of The Le@rning Federation (2002c).

3.6 Basic E -Learning Tool Set (BELTS)

3.6.1 Key business drivers for the development of BELTS

The Le@rning Federation identified the following key business drivers for BELTS. BELTS has been designed to provide:[17]

1 early delivery of learning objects to education systems and sectors;

2 a prototype for an enterprise system architecture for provision of learning to the education systems and sectors to assist with developing their own architectures;

3 a framework for an open-source learning management system, allowing the initial solution to continue being extended for the benefit of education systems and sectors; and

4 a system that assists education systems and sectors and schools to identify their requirements for learning management systems.

BELTS has been designed to interface with the Exchange[18] and learning management systems in the classroom. It has been designed to support both centralised and decentralised models for delivery of learning objects, and to enable users to perform the key functions of:

- searching and downloading learning objects from the Exchange
- administering system, user and content management
- using simple tools
- managing the Curriculum Organiser
- creating, managing and running lessons.

3.6.2 Deployment of BELTS

BELTS has been built as a single system with multiple functional modules that comprise the total functionality. It is intended that BELTS can be easily deployed on a range of different platforms, and the technical support information regarding the deployment of BELTS is provided in a format that is easy to use by a moderately skilled technical team.[19]

3.6.2.1 Models of deployment[20]

BELTS has been distributed to education systems and sectors.[21] It has been designed to support both centralised and distributed models for content delivery.

3.6.2.1.1 Central model[22]

The central model involves a single BELTS system servicing a number of schools, which access content over a wide-area network. The central education system or sector BELTS system is hosted in an application-hosting environment. At this level, in terms of functionality, there is no distinction made between education systems and sectors, nor between the ASPs and ISPs provided at a centralised level, to manage the discovery and distribution of content from the Exchange repository to a central BELTS repository. The centralised deployment model requires interfaces between the Exchange and BELTS that allow the discovery and transfer of content.

[17] The following section has been extracted from Section 2.2 of The Le@rning Federation (2002c).
[18] The Exchange is The Le@rning Federation's repository for housing learning objects nationally.
[19] See Section 2.4.5 of The Le@rning Federation (2002c).
[20] See Section 2.5.1 of The Le@rning Federation (2002c).
[21] See The Le@rning Federation (2003b).
[22] Ibid.

3.6.2.1.2 Distributed model[23]

The distributed model involves multiple BELTS systems deployed along a distribution chain down to the school level. Learning objects are pulled from the Exchange to the central education system or sector BELTS repository, and then distributed to the school BELTS repository. Learning objects (ie content) are delivered via a local-area network to classrooms.

3.6.3 Installation of BELTS

The Le@rning Federation has provided systems and sectors with initial support for the installation of BELTS[24] however, The Le@rning Federation has indicated that it is the jurisdictions' responsibility to develop suitable ongoing local approaches for the distribution, support and maintenance of BELTS in schools.[25]

3.6.4 BELTS' server configuration requirements[26]

The Le@rning Federation recommends the following requirements for the BELTS server.

3.6.4.1 Server hardware specification (minimum)[27]

- 1 x Pentium 4–1.5 GHz (or greater)
- 1 GB memory
- 18 GB hard drive storage (or greater)

3.6.4.2 Server system software configuration[28]

Operating system	Microsoft Windows 2000 Server or Linux (Red Hat Distribution) v 8.0
Database	PostgreSQL 7.2 Professional (other JDBC-compliant db products can be used but will not be tested by the TLF)
Application Server/EJB Container	JBOSS 3.2
Java 2 Environment	JDK 1.4.1
Browsers[29]	Microsoft Internet Explorer 6.0 or Netscape Navigator 6.2

3.7 Teacher and student computer software requirements

The Le@rning Federation learning objects have been designed to view within learning management systems (LMS) and web browsers. They have been developed and tested according to the software requirements listed below.

3.7.1 Browser software and operating systems

- Netscape Navigator 6.2 and Microsoft Internet Explorer 6.0 on Microsoft Windows 2000
- Netscape Navigator 6.2 and Microsoft Internet Explorer 5.2 on Apple OS X.

[23] Ibid.
[24] The Le@rning Federation (2002a).
[25] See The Le@rning Federation (2003b).
[26] See The Le@rning Federation (2002a).
[27] Ibid.
[28] See The Le@rning Federation (2002a) and The Learning Federation (2003e).
[29] See The Le@rning Federation (2003b).

3.7.2 Browser plugins

- SVG Adobe SVG Viewer Plug-in
- QuickTime QuickTime 5 Player
- PDF Adobe Acrobat Reader 5
- Flash MX Macromedia Flash Player 6
- Shockwave Macromedia Shockwave Player 8.5
- Java applets Java for Windows

3.8 Learning object size

The Le@rning Federation has identified the following specification for the download speed of its learning objects:

> A user is able to interact with the object within 10 seconds of the initial request on a 64 kbps connection where, for calculation purposes, 'interaction time' assumes a single user on a 64 kbps connection.[30]

[30] See The Le@rning Federation (2002b).

4 DESCRIPTION OF THE TRIALS

Four models for distribution of the learning objects were trialed in classrooms within the following regions of the National Catholic Education Commission:

- Canberra/Goulburn Archdiocese
- Melbourne Archdiocese
- Darwin Diocese.

4.1 Models used to trial BELTS

The trials focused on issues raised by using the following four distribution or delivery models:

- *Distributed model*
  A distributed delivery model was used in the Canberra/Goulburn Archdiocese with BELTS installed on the Catholic Education Office server located in Canberra and then replicated onto four individual schools' servers, each located in New South Wales. Configuration details of the servers used can be found on pages 42–44. All servers used Linux operating systems.
- *Centralised*[31] *model in education office*
  A centralised delivery model was used in Melbourne Archdiocese with schools accessing a BELTS server located in the Melbourne office of the Catholic Education Commission. The server had 34 MB of hard drive and used a Windows 2000 operating system.
- *Centralised ASP model using a service provider:*

  A centralised delivery model using an ASP (myinternet Ltd) learning management system was also used in the Melbourne Archdiocese.
- *CD-ROM delivery*
  A distributed delivery of the learning objects through the use of CD-ROMs was undertaken by teachers in four remote schools in the Northern Territory.

A diagram of the distribution chain is included in Appendix Four.

4.2 Method of data collection

A multi-faceted ethnographic approach underpinned the data-collection strategies used in the trials. Two questionnaires, one seeking reactions from teachers and one addressing technical issues, were prepared to focus the data collection for each of the models trialed. These questionnaires are included in Appendices Two B and Two C. The questionnaires were utilised differently in each location.

- In the Melbourne Archdiocese the questionnaires were completed by officers from the Catholic Education Office Melbourne.
- In the Canberra/Goulburn Archdiocese the trial questions informed the basis for the development of that Archdiocese's report.
- In the Darwin Diocese the questionnaires were completed by the teachers trialing the CD-ROMs.

During the course of the project, The Le@rning Federation hosted weekly teleconferences, which were conducted to monitor developments and emerging outcomes. In addition, in the Melbourne and Canberra/Goulburn trials, observations were conducted and notes maintained by the education officers in these Archdioceses.

[31] The definition of a 'centralised' distribution is adopted from The Le@rning Federation definition provided earlier, ie the server is located centrally within the system or sector downloading the objects.

4.3 Settings for the trials

A total of 15 schools in two Archdioceses and one Diocese participated in the trial. Wherever possible, the online trials were conducted under 'authentic' conditions with teachers using the learning objects in the classroom with students.

The CD–ROMs, however, were trialed by teachers only.

'Central' support was provided 'on request' by officers from The Le@rning Federation to officers located in the respective regional Catholic Education Commission offices. The regionally based Catholic Education officers provided support and expertise to teachers in the schools.

4.3.1 Learning objects

Different learning objects were used in the three locations:

- *Finders Keepers* (a literacy learning object) was used in the Canberra/Goulburn Archdiocese and the Darwin Diocese;.
- *Indigestion* (a science learning object) was used in the Melbourne Archdiocese.

Other learning objects were investigated by teachers and students during the course of the trials, but the above learning objects were used as the focus for the respective trials.

4.3.2 Location, bandwidth and IT configurations

The settings in which the learning objects were accessed using BELTS differed between the three trial locations. The following section provides a summary of the nature of the trial location, the extent of the bandwidth available, and IT configurations in which the trials were conducted. Details of the schools' enrolments, their location, telecommunication connections and IT facilities are included in Appendices Five and Six.

Canberra/Goulburn

The Canberra/Goulburn Archdiocese straddles the Australian Capital Territory and part of New South Wales. The Canberra/Goulburn Catholic Education Office is located in Canberra. The Archdiocese is about the size of Tasmania.

The Canberra/Goulburn Catholic Education Office has been in the process of constructing a Wide Area Network (ACGNet) connecting all of its schools across the ACT and south-eastern New South Wales. The WAN involves central servers located at Dickson and Manuka in Canberra, with gateway servers in each school. The central and gateway servers are all Linux-based servers (Red Hat 7.4), and they handle all the traffic out of the schools and into the central management area. The fact that BELTS can be deployed as a Linux service encouraged the Canberra/Goulburn Catholic Education Office to participate in the project.

Four New South Wales Central Schools, each with students ranging from Kindergarten to Year 10, were selected and agreed to participate in the trial. All of the schools had been connected to ACGNet and were familiar with use of the network. Two schools had an ADSL connection; one school had a satellite connection; and the fourth school began with a satellite connection, and during the trial, in October 2003, changed to ADSL. Bandwidth varied, with three schools having a download speed of 512kB and one school having a download speed of 220kB. Three schools had an upload of 128kB, and one school had a 33kB upload speed.

This trial focused on establishing a distributed method of deploying BELTS and identifying the issues and requirements for such a distribution model. The complete report of this trial is available in Appendix One. The trial report focuses on the server requirements in order to undertake a replication of BELTS onto school-based servers.

Melbourne

The Melbourne Archdiocese covers schools in the Melbourne greater metropolitan area and includes Geelong. Two centralised models of deployment of BELTS were trialed concurrently in this Archdiocese. As myinternet Ltd is the ASP for a number of Catholic dioceses across Australia including the four Catholic dioceses in Victoria, an ASP model of distribution was

trialed using myinternet Ltd. A second distribution was also trialed, using BELTS located on a central server located in the Melbourne Catholic Education Office. Officers at The Le@rning Federation configured the server used to deploy learning objects from the Melbourne Catholic Education Office.

Schools were chosen to trial BELTS by officers in the Catholic Education Office, Melbourne. A cross-section of schools was chosen in order to trial a variety of types and sizes of configurations and bandwidth into schools. The bandwidth varied from schools with 64 kB up to 1.5 MB in bandwidth, and one school had 1024 kB DAR. Participating teachers had some knowledge of learning objects and/or of using technology.

All the Melbourne trial schools except Avila College are part of the Catholic Education Victorian Network (CEVN) using the ASP myinternet. Avila College has a private arrangement with a local ISP and is charged on a 'per MB' of download.

At each trial school and on all computers tested, the same learning object, *Indigestion,* was selected, using both the BELTS server and the myinternet Ltd portal as the delivery mechanism, except at Avila College, where only the BELTS server was trialed.

The primary classrooms in which the trials were conducted had between three and five computers in each room. The learning objects were trialed on the computers that already had the required software installed. Sometimes five computers were used simultaneously; sometimes only one or two computers were configured to handle the learning objects. In the secondary classes, students viewed the learning objects in a computer laboratory with between 20 and 25 computers accessing the object at any one time.

Northern Territory

Remote schools within this Diocese have unreliable electricity, telecommunications and Internet access due to the weather conditions in their geographical locations. Tropical conditions such as heavy rain and lightning strikes are common in the Darwin Diocese, particularly during the wet season.[32] Furthermore, due to their geographical location, some remote schools cannot be physically reached during the wet period, which means that the provision of technical assistance to them can be compromised. Consequently for these remote schools, provision of learning objects via the Internet cannot be guaranteed and in these cases CD-ROMs or DVDs may provide a more robust delivery platform. As such, the Northern Territory component of the BELTS trial focused on using CD-ROMs for the deployment of learning objects.

Four 'remote'[33] Northern Territory schools in the Diocese of Darwin were selected by the Coordinator of Curriculum and Indigenous Education in the Catholic Education Office in the Northern Territory to participate in this part of the project. Five teachers from these four schools participated in the trial. The teachers selected were those with IT responsibility in the school, eg the ICT teacher. In one case a classroom support teacher participated.

Of the four schools, one was a primary school, one a secondary school, and two were primary and secondary on one campus. Secondary schools in this context generally cater for students up to 15 years of age, with some VET programs for a few older students.

Most Catholic schools within the Darwin Diocese are part of the Northern Territory government 'Learning and Technology in Schools' (LATIS) network.[34] Part of LATIS includes the LATIS Software Bank. All software titles to be played on LATIS workstations in schools must be certified before they are installed. A list of approved software is kept of all products that have been submitted for certification and are available on the LATIS website.[35] If schools want to use software on LATIS workstations that is not included on the software list, it is the school's responsibility to submit the software for certification.

[32] The wet season (ie tropical summer) is between 1 November and 30 April.

[33] 'Remote' schools in the NT are those schools located in small Indigenous communities with variable access to major centres such as Darwin and Alice Springs (eg between one and five hours travel by unsealed road depending on the season, and limited to small plane access). The student population of the schools in this study ranges between 60 and 250.

[34] Information about LATIS is available from http://www.latis.net.au.

[35] Ibid.

All trials of the learning objects using the CD-ROMs had to be conducted on stand-alone computers, either in teachers' homes or using stand-alone legacy machines, as the LATIS workstations do not have individual CD-ROM players installed. At the time of the trial the CD-ROMs had not been 'LATIS' certified and therefore could not be played on the LATIS workstations through their associated CD-ROM towers.

Teachers in the four participating schools were provided with:

- a CD-ROM with a selection of learning objects (literacy for students at risk and maths and mumeracy) and links to the required plugins for downloading from the Internet
- brief handwritten instructions outlining how to access the learning objects
- two questionnaires to be completed by teachers trialing the CDs
- a summary of the technical requirements for accessing BELTS.

Teachers completed the questionnaires and returned them to the Darwin Catholic Education Office.

4.4 Support made available to the trial schools

Teachers in the Melbourne and Canberra/Goulburn Archdioceses were provided with a small amount of face-to-face inservice on how to use BELTS for constructing lessons. No training was provided to the Northern Territory teachers trialing the CD-ROMs.

In the Canberra/Goulburn Archdiocese, training was run at Cootamundra at the commencement of the trial. Teachers in all participating schools were taught how to use BELTS to access learning objects and were encouraged to construct sequences of learning.

In the Melbourne Archdiocese, two teachers from both participating secondary schools attended a half-day training session at the Catholic Education Office. This training session provided teachers with the opportunity to understand the concept of a 'learning object', and to learn how to create an online sequence of learning in BELTS using learning objects.

No training was provided to the primary teachers participating in the Melbourne trial. It was decided that, as all Catholic primary schools in Victoria had used the myinternet portal for the last five years, training was unnecessary.

All teachers in the Melbourne Archdiocese were provided with support documentation on how to use BELTS in the classroom. A copy of this booklet is included in Appendix Seven[36].

Teachers in the Northern Territory were provided with brief handwritten instructions on how to install the learning objects.

[36] This booklet was developed from the Department of Education and Training (Vic) E-Learning team booklet (2003): *BELTS training scenarios for teachers*.

5 OUTCOMES FROM THE TRIALS

The trials of BELTS were established using an holistic approach, with each individual trial contributing a different perspective to the overall project. The trials achieved several outcomes and raised a variety of issues in relation to the deployment of BELTS. In this section, observations are made about the complexity of the environments in which the trials were conducted; and then the outcomes achieved through the trials are addressed according to the identified purposes of the trials. Recommendations, where appropriate, follow each subsection.

5.1 Complexity of the trial environments

Reporting on the outcomes from these online trials is complex due to the trials being conducted in 'live' environments, in which there were many factors that potentially could contribute to the success or failure of a learning object being delivered to the desktop using BELTS. Environmental factors impinging on these trials included:

- the range and variety of hardware and software configurations pre-existing in schools
- whether the computers were appropriately configured (at both back and front ends) according to The Le@rning Federation specifications prior to the commencement of the trial
- the size of the server and the number of users accessing it concurrently
- the bandwidth available to schools
- caching capabilities
- the fluidity of the development of the BELTS software and associated documentation during the trial
- software upgrades that occurred during the trial (eg plugins) but were outside of the direct control of The Le@rning Federation
- varying levels of technical expertise in the Catholic Education Offices and in schools
- varying levels of ICT literacy among teachers.

While the trials had identified purposes, it has not been possible to determine the extent of influence each individual factor has had on the delivery of learning objects to the desktop. As such, the following notes are provided to outline potential 'environmental' issues, but no judgement is made here as to whether the issues identified influenced the outcomes achieved through these trials.

5.1.1 Hardware and software configurations pre-existing in schools

The computer configurations outlined in the reports included in the Appendices show clearly that there is a range and variety of hardware and software configurations in use in the trial schools. Not all of these configurations match the requirements specified by The Le@rning Federation for the successful delivery of learning objects.

The following examples are provided as illustration:

- Operating systems. Computers used in classrooms were employing a variety of operating systems ranging from Windows 95 through to XP and Macintosh. However, not all the operating systems used in the trial schools are supported by The Le@rning Federation specifications.[37]

[37] See The Learning Federation (2003e). It should be noted that Microsoft has indicated it will cease providing support for Windows 98 as of 16 January 2004.

- Processors and memory. Trials were conducted on computers with low levels of processing power and memory through to computers exceeding the specifications identified by The Le@rning Federation.
- Browsers and plugins: Again, a range of browsers and plugins were used as part of the trials. However not all computers had the specified browsers installed prior to the trialing of BELTS and learning objects.

5.1.2 Configuring computers appropriately

Regardless of the model used for deploying BELTS, the servers and computers in schools require appropriate configuration, consistent with The Le@rning Federation specifications, to be interoperable both with the Exchange and with the requirements of the respective local or wide area networks. While a range of different configurations was trialed, including some outside The Le@rning Federation specifications, the extent to which the 'below specification' configurations of the trial computers affected the outcomes achieved through the trials is not clear.

5.1.3 Size of server

It has emerged that the size of the server and the number of concurrent users accessing it are important considerations in order to handle the application requirements for the deployment of BELTS. At a central jurisdictional level The Le@rning Federation has specified:

- 1 x Pentium 4 – 1.5 GHz (or greater)
- 1 GB memory
- 18 GB hard drive storage (or greater)[38]

Further useful information would be provided by server impact tests according to the model of deploying BELTS, and by developing specifications for the size of server required in a distributed, replicated environment.

5.1.4 Bandwidth available to schools

The reports in the Appendices show that the trials were conducted using a range bandwidths: from 64kB through to 1.5MB. As outlined earlier, The Le@rning Federation has specified the range of acceptable download time for a learning object. While it would appear that available bandwidth does affect the speed of downloading learning objects, it is difficult to ascertain with certainty the degree and extent of the effect, given the number of interrelating factors that affect the delivery of the learning objects to the desktop.

5.1.5 Caching capabilities

The capacity for servers to cache learning objects emerged as an important issue during the course of the trials. The reports from the Canberra/Goulburn (Appendix One) and Melbourne Archdioceses (Appendix Two) both address this issue. The ability to cache appears to depend on several factors, but it was not possible to ascertain, from this trial, the extent to which caching influences the ability of BELTS to deliver learning objects to computers in classrooms. Factors which seem to influence the ability to cache include:

- the nature of the caching software
- the size of caching capability
- the nature of the files to be cached
- how the files are tagged.

[38] See The Le@rning Federation (2002a).

5.1.6 The fluidity of BELTS' development

During the trial, different iterations of BELTS and associated patches were released. BELTS developed from version 1.0 through to version 1.1.3 during the course of the trial. In addition, when the trial commenced BELTS did not have the replication functionality required to underpin the distributed, replicated model identified for trialing in the Canberra/Goulburn Archdiocese. While this ongoing development of BELTS was necessary for The Le@rning Federation both to iteratively learn from the trials of BELTS and to meet its timelines, the outcomes from the trials have to be viewed in the light of the changing nature of BELTS over the trial period. This changing status of BELTS also makes it difficult to determine whether issues raised during the course of the trials were substantive or iterative in nature.

5.1.7 Upgrades to required software

During the course of the trial Macromedia upgraded its Flash plugins; however, in Microsoft XP Flash 6 would not install over Flash 5.5.(see Appendix One). While the consequences of this plugin upgrade could be seen as idiosyncratic, it highlighted two broader points:

- Where upgrades generate unexpected incompatibility issues, time-consuming troubleshooting responses can result, and these can be replicated across geographical and jurisdictional boundaries.
- The Le@rning Federation is currently scheduled to develop learning objects up to 2006. It is not possible to foresee the type of upgrades to operating systems, browsers and plugins that may occur over that time.

Such uncertainty in the development environment makes the creation of learning objects and other software a complex and problematic task.

5.1.8 Varying levels of technical expertise

Both the Canberra/Goulburn and Melbourne Catholic Education Offices have experienced technical expertise available. Using open-source software solutions such as those underpinning BELTS was seen as a newly emerging IT competence. In the Canberra/Goulburn Archdiocese the open-source operating system Linux was already being deployed and so there was some familiarity with the nature of open-source environments, their functionality requirements and their associated documentation. Given the fluidity of the trial environment, coupled with installing and trialing new software, the technical demands of the trial were high compared to the usual 'off-the-shelf' technical expertise required for installing established software.

It is difficult to determine from this trial, however, the likely future extent of technical expertise required once BELTS is 'bedded down'. Several installations have been completed and the installation of the software is becoming more akin to other 'off-the-shelf' products.[39]

5.1.9 Varying levels of ICT literacy among teachers

Teachers selected to participate in all three trials had already developed ICT literacy skills.[40] It became apparent through the trials though, that teacher professional development in the technical and pedagogical use of BELTS and learning objects is central to gaining the most value from both BELTS and the learning objects.

5.1.10 Summary and recommendations

It can be seen from the range of variables that impinged on the conditions of the trials, that the trial environments were complex. As such, isolating causes and effects from the apparent findings of the trials has been problematic. Identifying the variables impinging on the trials, however, has been an important first step and should be used to inform any follow-up work. Should future work

[39] To aid in the installation process of BELTS, officers in the Canberra/Goulburn Archdiocese have developed a CD-ROM installation disk.

[40] Here 'ICT literacy' refers to familiarity with the computer and online environments, and the ability to use software programs for their own purposes.

be undertaken, some of it should be planned and performed under test conditions, where the software used is stable and the variables are controlled and altered according to planned processes, so that specific cause and effect outcomes can be ascertained.

It is therefore recommended that, should further trials be considered:

- tests of identified variables are undertaken within controlled environments in which the software remains unchanged during the course of the tests in order to isolate and document troubleshooting requirements for identified problems;
- simple one-page 'client end' and 'server end' configuration charts are developed for use in schools and jurisdictions to ensure that the computers used to access learning objects are appropriately configured prior to attempting to use the learning objects;[41] and
- software is developed that will automatically check whether the 'client computer' is configured correctly to access and use learning objects.[42]

5.2 Addressing the purposes of the trial

Subsection 6.2 outlines some tentative findings arising from the trials at both jurisdictional and national levels. Discussion is constructed around each of the questions identified as part of the purposes for the trials (see Section 4.2). Detailed information about the respective outcomes of the trials can be found in the reports provided by each of the Catholic Education Offices. These reports are located in Appendices One, Two and Three.

5.2.1 Technical support staff required at school and system levels

Both the Canberra/Goulburn and Melbourne trials indicated that to install BELTS required open-source technical expertise. Both Catholic Education Offices employ technicians with open-source software and, in particular, Linux expertise. Both offices reported that when installation ran in a straightforward manner there were no insurmountable problems. However, when troubleshooting was required, a very high level of open-source expertise was required and for this both offices relied upon The Le@rning Federation. In addition, both trials reported that the technical documentation available was not easy to understand on the first reading. It was reported, however, that the technical documentation made more sense once an installation had been completed.

Implications on a broader scale suggest, then, that technical expertise that includes open-source software expertise and the ability to problem solve outside 'off-the-shelf' packages is an emerging skill required in school education jurisdictions and in schools. While this skill is available within several jurisdictions and was available in this trial, it is not currently widespread across Australia. It is unclear from this trial whether the level of technical expertise required to install and maintain BELTS initially will remain high or whether it will reduce once we pass through the learnings essential to the initial start-up phase. Ongoing monitoring of the required technical skills during 2004 and 2005 will be needed to determine whether the installation, maintenance and troubleshooting of BELTS remain tasks requiring high levels of technical expertise.

Most of the teachers trialing the CD-ROMs in the Darwin Diocese experienced difficulties with accessing the learning objects. Given that those who will use CD-ROMs have to be completely self-contained, the technical demands of installing and using the CD-ROM must be minimal. A tutorial and/or hardcopy documentation to support them with information on how to install and use the CD-ROM would have eased their difficulties.

Recommendations

- That the range of trials of BELTS being undertaken across jurisdictions is monitored by the Exchange Consultative Committee (ECC) to ascertain whether subsequent installations of BELTS attract the same levels of difficulty reported through this trial.

[41] These charts should include all the required information and should not ask the user to jump to URLs to check for further information.
[42] It should be noted that work on this task has already commenced.

- That a national pool of people with expertise in installing, maintaining and troubleshooting issues arising from the use of BELTS is established and maintained online, and is accessible via emails and listservs.
- That the Exchange Consultative Committee gives consideration to training help desk officers within jurisdictions in troubleshooting strategies to support the use of BELTS.
- That the CD-ROMs developed for use in remote schools include an installation tutorial and associated hardcopy documentation on how to use the CD-ROM and the learning objects.
- That software is developed that will automatically check whether the computer is configured correctly to access and use learning objects available via CD-ROM.

5.2.2 Training required by technical support staff at school and system levels

Between a half and a full day's training in how to use BELTS was provided for the Canberra/Goulburn teachers and for the secondary teachers in the Melbourne trial. It appears from these trials that this level of training was sufficient for teachers to be able to commence using BELTS for accessing learning objects and constructing lessons. The more the system was used the more proficient the teachers became in using BELTS.

Teachers trialing the use of learning objects within myinternet had already been trained in how to use this system and were able to use it to access the learning objects. It should be noted, however, that the costs of training to use myinternet were not included in the purchasing of myinternet. The Catholic Education Office in Melbourne covered the training costs as part of the rollout and upgrade of the software to schools.

As indicated above, the teachers in the Northern Territory were not provided with any training and with scant documentation. They would have benefited from an installation tutorial and associated hardcopy documentation on how to use the CD-ROM and the learning objects.

Given the foregoing comments about the nature of the technical expertise required for administrators to install and maintain BELTS, consideration could be given to a national strategy for increasing the technical skill levels of relevant officers within all government and non-government jurisdictions. One strategy to achieve this could be the provision of training sessions using both synchronous and asynchronous learning tools, accompanied with an annual face-to-face meeting. In the first instance, sessions could be conducted between 2004 and 2006.

Recommendations

- That small focused trials of the BELTS technical documentation, and of the teachers' and students' handbooks (see http://belts.sourceforge.net/teacher/index.html) are undertaken.
- That publicity and awareness raising about the location of the BELTS handbooks and technical documentation is conducted with jurisdictions to support their professional development of teachers using BELTS.
- That consolidation of all relevant BELTS documentation and support documents is undertaken and housed publicly on the BELTS site (http://belts.sourceforge.net).
- That jurisdictions, through the ECC, give consideration to providing training for technical administrators in how to install, maintain and troubleshoot within BELTS.
- That small widespread trials of the BELTS installation disk developed by officers in the Canberra/Goulburn Catholic Education Office are conducted to establish whether the installation disk could be used nationally as an easy installation method.

5.2.3 Time needed for setting up, supporting and maintaining BELTS

At this stage, the time needed for setting up, maintaining and supporting BELTS cannot be predicted in an easy and straightforward manner. During the course of both the Melbourne and Canberra/Goulburn trials, frustrations and time delays were experienced with the set-up

of BELTS. There were several reasons for this, including the fact that BELTS itself was still under development. The reports of both these trials provide insights into the nature of these frustrations as well as the predicted times for setting up and using BELTS (see Appendices One and Two).

Theoretically, the installation of BELTS, once stable and complete, should be simple and rapid. Should the installation not proceed smoothly, however, the time taken to resolve the problems will depend on the nature of the problem and the availability of suitably competent Linux technical support. As BELTS is a new and emerging piece of Australian-developed software, there is a need to develop a critical mass of technicians skilled in how to manage and troubleshoot within it. However, as more and more people become familiar with its set-up and operations, and as learning about the software itself takes place, it could be predicted that, over time, the time required to set up, support and maintain BELTS will decrease.

Recommendations

- That small, widespread trials of the BELTS installation disk developed by officers in the Canberra/Goulburn Catholic Education Office are conducted to establish whether the installation disk could be widely used nationally as an easy-installation method.
- That a 'Frequently asked questions' or 'Helpful hints to troubleshooting BELTS' page be maintained over time on the BELTS sourceforge site.
- That a national pool of online experts in installing, maintaining and troubleshooting issues arising from the use of BELTS is established and maintained.

5.2.4 What are the issues in installing the box onto a network?

These trials indicate that the initial issues with installing a 'BELTS box' onto a network were related to: the fluidity of the development of both BELTS and the associated technical documentation; and the newness of the product and the consequent need for technicians to learn it. Hence it is difficult to determine whether the issues identified during the trial were substantive or transient. Neither the Canberra/Goulburn or Melbourne Archdioceses specifically recorded ongoing problems with installing BELTS onto a network.

Recommendation

- That the issues arising from installing a BELTS box onto a network, including an analysis of server loads, are revisited and tested once this iteration of BELTS is completed and signed off.

5.2.5 What are the expectations for download times/bandwidth? What are the implications of the actual download time?

The Le@rning Federation has already established the expectation concerning download speeds of learning objects:

> A user is able to interact with the object within 10 seconds of the initial request on a 64kbps connection where, for calculation purposes 'interaction time' assumes a single user on a 64kbps connection.[43]

The download speeds of learning objects varied across schools within and across the respective trials. It is difficult to isolate the causes for the speed –or lack of it – given the number of variables that could affect the downloading learning objects, although available bandwidth, ability to cache, available hard drive space; memory, number of concurrent users and compatibility of software and plugins all seem to impact on whether learning objects download satisfactorily. It would appear from the outcomes of the Melbourne trial that where there was ample bandwidth the learning objects could be downloaded almost instantaneously even on machines with low levels of memory, hard drive and processing power.

The outcomes from the 'speeds of download trials' achieved through the Melbourne trial are recorded on pp 85–86. It should be noted, however, that while some of the times documented

[43] See The Le@rning Federation (2002b).

were more than 30 seconds, the report of the Melbourne trial indicates that, as the students seemed to enjoy using the learning objects, and if they knew to expect the learning objects, they seemed happy enough to sit and wait for their arrival, even when the learning objects took more than 30 seconds to download. A broader question to ask, however, is, 'is the waiting for downloads of learning objects a prudent use of classroom time?'

An associated issue that arose in relation to the download times was the question of caching. It became apparent that the nature of students' use of the learning objects included playing and replaying the objects. If the objects are cached then the replay of the objects can occur almost immediately. If the objects do not cache and the school is not within a VPN, then a risk for the school is that downloads could rapidly become expensive.

Recommendations

- That further testing and analysis of caching requirements of learning objects is undertaken.
- That optimum server and client side computer and bandwidth configurations are documented and circulated to jurisdictions.

5.2.6 How do the learning objects behave when delivered to schools (ie are there any learning objects implementation issues)?

Where computers were configured according to specifications identified by The Le@rning Federation there did not appear to be any major problems with their performance. The importance of ensuring that the computers are installed with the correct browser and plugins however did emerge as an important management and implementation issue pertinent to both online and CD-ROM deployments of the learning objects.

Recommendation

That software is developed that automatically checks whether the computer is configured correctly to access and use learning objects.[44]

5.2.7 Expected and required professional development[45] needs at school and system levels

The trial reports demonstrate that only a small amount of teacher professional development was required to enable teachers to use BELTS at a functional level for constructing lessons that incorporate learning objects. Addressing more complex pedagogical issues, however, will require longer and more detailed professional development. Issues emerging from the trials that would require more detailed professional development included the following:

- identifying the protocols for clearly identifying the lessons created in BELTS
- identifying strategies for managing classes of students
- identifying strategies for using unique lesson IDs
- identifying strategies within BELTS for sharing lessons between teachers
- asking critical and philosophical questions about online learning.

The importance of establishing national support mechanisms for technical officers has been mentioned earlier. This point is reiterated here as the quality of the online learning experience, for both teachers and students, can be coloured by the reliability and functionality of the software being used.

Recommendations

- That small focused trials of the BELTS technical documentation, and of the teachers' and students' handbooks (see http://belts.sourceforge.net/teacher/index.html), are undertaken.

[44] Work has already commenced on this task.

[45] It should be noted that professional development is a jurisdictional responsibility; however, it can be undertaken in a nationally consistent fashion.

- That jurisdictions share case studies of examples of good practice using BELTS.
- That publicity and awareness raising about the location of the BELTS handbooks and technical documentation is conducted with jurisdictions to support their professional development of teachers using BELTS.
- That consolidation of all relevant BELTS documentation and support documents is undertaken and housed publicly on the BELTS site (http://belts.sourceforge.net).
- That jurisdictions, through the ECC, give consideration to the provision of training for technical administrators in how to install, maintain and troubleshoot within BELTS.
- That small, widespread trials of the BELTS installation disk developed by officers in the Canberra/Goulburn Catholic Education Office are conducted to establish whether the installation disk could be widely used nationally as an easy installation method.

5.2.8 What technical skills do teachers need to make effectiveuse of BELTS
What skills and learning and teaching strategies do teachers need to integrate the learning objects into the curriculum?

None of the trials directly addressed the skills profile a teacher requires to use BELTS effectively nor addressed teaching and learning issues using learning objects as part of the curriculum.

Given the relative simplicity of BELTS and the short amounts of time provided in the trials to the training of teachers in how to use BELTS, it would appear that basic ICT literacy skills are required, plus an openness to learn a new software packages. The trials found that once teachers were proficient at using BELTS they then started looking for additional functionality to amplify its' use.

Critical issues about how to integrate learning objects into the curriculum are, however, likely to emerge as BELTS becomes more extensively used.

Recommendations

- That jurisdictions are encouraged to develop portfolios or case studies of good practice by teachers using BELTS and for these to shared nationally.
- That questions concerning the technical skills teachers require to make effective use of BELTS, and the skills teachers require to integrate learning objects into their teaching and learning, are revisited by the Exchange Consultative Committee later in 2004.

5.2.9 How will BELTS be integrated with a learning management system and what are the additional costs, management and professional development this brings?

None of the trials directly addressed this question. Costs associated with the purchase of commercial learning management systems depend on the package put together by the vendor, which could include the software product itself, the licence agreements and the training and help desk or support services provided by the vendor. The development of BELTS has come at a time when jurisdictions are reconsidering the amounts of funding allocated to the purchase of off-the-shelf software. As such, BELTS may represent a suitable, widespread software environment for use in schools over the next three to five years as jurisdictions determine their future software priorities.

It is expected that the Exchange Consultative Committee will be considering a range of issues related to learning management systems during 2004, and the above question could be included within these future considerations.

Recommendations

- That the question of 'how will BELTS be integrated with a learning management system and what are the additional costs, management and professional development this brings?' be considered by the Exchange Consultative Committee in 2004.

- That a total cost of ownership framework is developed to allow comparisons between BELTS and other proprietary learning management systems.

5.2.10 Is a BELTS server better placed at individual school level or is an ASP or regional delivery model better?

Clear and irrefutable justification for a preference of one distribution model over another did not emerge from this trial.

5.2.10.1 Central models

The trial in the Melbourne Archdiocese found little difference in the speed or quality of the delivery of learning objects accessed using BELTS and myinternet. A difference emerged however in relation to the payment of download costs.

The myinternet server is housed within the Catholic Education Office Melbourne virtual private network (VPN). The myinternet trial schools did not pay for download costs, regardless of the number of times they use the TLF learning objects, because they were accessing the content from within the VPN. However, those schools accessing content via BELTS, which was not located within the VPN, were charged download costs based on the frequency of use of the learning objects. The location of the learning object repository within or outside of the VPN will impact on the cost of delivery and use of objects at the school level.

Hence, total cost of ownership should include the cost of accessing, managing and downloading the learning objects.

5.2.10.2 Distributed model

Once the replication function was added to BELTS, the delivery of learning objects using a distributed model was found to be acceptable by those within the Canberra/Goulburn Archdiocese.

5.2.11 Pros and cons

The following table identifies the pros and cons identified for using a central server or a distributed server, an ASP or CD-ROMs.

	Pros	**Cons**
Centralised BELTS server	There is only one place into which objects have to be loaded	Management practices are required to handle naming for lessons and users
	Only one server is required to manage all aspects of the distribution process	There is the potential for server performance degradation under loads (eg over 20 schools
	Technical support can be centralised and deployed more efficiently	A centralised technical support may not be responsive to localised requirements
	Lessons can be easily shared with other users on the network	If the server goes down then all schools are out
	Professional development can be delivered off the central box	Objects can be cached at the local school level
Distributed BELTS servers	Lessons and objects are available on the LAN	Management practices are required to handle the download and distribution of objects at both central and local levels

	Lesson naming is only critical on the LAN	Duplication of the management of each of the dependent systems is required
	Caching is not as critical for deploying the objects locally	Many servers are required
	If the server goes down the only the local school is out	Management strategies to handle multiple servers and dependent systems are required
	The server can handle multiple functions including BELTS (eg caching, firewall)	Upgrades need to be applied to each server
ASP	All management responsibility for the regular downloads of learning objects from the Exchange and distribution to local sites is delegated to ASP	If the ASP's server goes down then all schools go out
	Costs of downloads, upgrades and maintenance of software (for example), are included in the online environment and are packaged into a single cost	Using the online learning environment provided through the ASP requires professional development in addition to that required to learn how to use the BELTS
	It is the responsibility of the ASP to resolve issues as they arise, according to the contract and the agreed specifications	Specific management practices are required to handle naming for lessons and users
	All users work in the same online learning environment	Management of the licences and monitoring of the contract to ensure that the goods and services being purchased are being delivered must be undertaken by the customer
	Technical expertise is the responsibility of the ASP	Jurisdictions pay both for the ASP's online learning environment and BELTS
CD-ROM/DVD	Access to learning objects is not dependent upon access to the Internet	Management of different versions of CD's will be required as new learning objects are released or where old learning objects are updated
	Use and reuse of the learning objects does not involve bandwidth or costs of downloads	As the pool of learning objects grows its likely that several CDs will be required or alternatively DVDs will have to be used for storage, yet it is not known how many remote schools have access to DVD players
	Learning objects should be able to be accessed rapidly	Plugins have to be installed on any computer without access to the Internet
	Management practices are not required to handle naming for multiple users and their lessons unless the school is using a LAN	Sharing lessons between teachers can only occur via a LAN, through sharing the same computer or via a hardcopy

As a result of the trials, judgements of where to locate a BELTS server remain questions for individual jurisdictions to answer. Philosophical questions such as the place of local school management in the deployment of software, and the costs and benefits of different models of deployment, will have to weighed up at the jurisdictional and/or school level. Issues to consider could include (for example):

- the level of expertise available to manage multiple BELTS servers at the local level versus managing a single server centrally;
- managing BELTS 'in house' versus paying an ASP to handle all the management and maintenance required; and
- the degree to which BELTS meets the online learning environment requirements of a jurisdiction for the short-term future.

5.3 National level

While this jurisdictional trial did not deliberately test the key national drivers of BELTS, some findings have become apparent concerning the four overall aims originally identified for developing BELTS[46]. These are discussed briefly below.

5.3.1 Provide early delivery of learning objects to education systems and sectors

Through this National Catholic Education Commission trial it is clear that BELTS does provide a national delivery mechanism for accessing learning objects and structuring them into lessons or sequences of learning. Through using BELTS teachers and students are able to gain experiences that will help them become more effective users of learning objects and the learning management systems that are used to manipulate and contextualise them.

5.3.2 Provide a prototype for an enterprise system architecture to provide learning to the education systems and sectors to assist with developing their own architectures

BELTS has provided jurisdictions with a working prototype of a simple learning management system. Given that teachers in most jurisdictions are only now moving towards incorporating online learning into their classroom activities, the development of a simple working prototype is timely.

As teachers have become familiar with the use of BELTS they have then started to identify further functionality they would like to see. Examples of requested additional functionality include:

- import and export functions
- a reminder to save information
- an ability to interface with other learning management systems and other learning objects
- the ability to tell which version of BELTS a server has installed on it
- thumbnails of learning objects
- the ability to transfer lessons seamlessly and automatically from one version of BELTS to another
- the ability for teachers to view and share lessons across schools.

Additional enhancements could form the basis of further open-source collaborative work, should this been seen as valuable by jurisdictions,.

5.3.3 Provide a framework for an open-source learning management system, allowing the initial solution to continue to be extended for the benefit of education systems and sectors

Through the use of open-source software and licences, BELTS has provided intelligence through practical example about the sorts of standards and functionality required in an online

[46] Aims for the development of BELTS are summarised on p11 of this report

learning environment that is appropriate for use in schools. As such it can be of benefit to the Australian school community.

BELTS has been built to be modular and scaleable. To date, jurisdictions and schools have tended to focus on the technical practicalities of getting BELTS installed and functioning. As a community, once the schooling sector becomes familiar with BELTS and moves beyond these immediate practicalities, strategies for engaging with the collaborative culture underpinning open-source software developments could be considered. Improvements to the extent of the functionality provided by BELTS could be a focus for future national collaborative developments.

5.3.4 Provide a system that assists education systems and sectors and schools to identify their requirements for learning management systems

Most off-the-shelf or commercial learning management systems have been developed for use in the higher education sector and vendors are now marketing these solutions to the school sector.

It has been demonstrated through this particular trial that BELTS has the capacity to enable teachers to identify their requirements for learning management systems. As indicated earlier, as teachers and others begin to use BELTS they start to identify additional functionality that they would like to see. While it may be that these requests for additional functionality can be included in requests to vendors, these requirements can also be identified as open-source projects for the future development of BELTS through the pooling of expertise nationally.

6 CONCLUSION

This suite of trials of BELTS has provided insights at national, regional and school levels into the uses that can be made of BELTS: the potential enhancements of BELTS and the potential deployment models of BELTS. One of the intentions of the trials was to assist The Le@rning Federation to evaluate stakeholders' understandings of the delivery of online content to schools. To this end, this project has generated a large amount of both formal and informal data. The project was established both to respond iteratively to findings, and to document key outcomes generated through these trials for lengthier consideration. As a result of the trials The Le@rning Federation and the National Catholic Education Commission have gained information that they have been able to act upon immediately and information that will require action in the longer term.

Three key findings emerging from the trials were that:

- no distribution model is more preferable than any other *per se*, but the selection of a model of distribution depends on the requirements of the local conditions;
- schools and jurisdictions require provision of support through access to technical expertise synchronously and asynchronously via email and websites, and through tailored online self-help documentation; and
- further research is required into the total cost of ownership of the respective distribution models.

Three key or central considerations were identified through the trials as impinging on decisions about which deployment model a jurisdiction may wish to adopt. The considerations identified were:

- bandwidth and costs of downloads
- caching capabilities
- server loads.

Associated with the technical requirements for successfully deploying BELTS, the trials highlighted the importance for schools and jurisdictions having in place administration and management strategies both for updating the available suite of learning objects, and for easy identification and reuse by teachers of the sequences of learning they create, save and hold on servers.

It has become clear that plugins are central to the ease of use and appropriate functioning of the learning objects.

A series of recommendations have emerged from this project. Decisions about how to respond to these recommendations are in the hands of the respective jurisdictions and will be discussed at Exchange Consultative Committee meetings in 2004. These meetings will be events not to be missed.

7 REFLECTIONS

by Mr Adrian Brown (National Catholic Education Commission)

With the publication of BELTS v 1.1.3 repository replication has been enabled allowing the distribution of The Le@rning Federation objects over a more widely dispersed field and, as a consequence, more extensive testing of these objects in real classrooms together with experimentation with using BELTS as a learning management system.

These experiences will help both teachers and students to become more effective users of learning objects and the learning management systems that are used to manipulate and contextualise them. While BELTS is designed as a basic e-learning tool set and it does not have the advanced features of some of the commercial learning management systems (eg tracking of student progress), its simplicity has the advantage of familiarisation with the newly evolving digital pedagogy. Furthermore, when the time comes for making purchases, those purchases will be much more informed.

While the New South Wales Catholic Education Commission will replicate the Catholic repository in Melbourne, delivery of objects to schools will mainly occur from diocesan offices.

At the diocesan level two alternative models for deployment are emerging – each with its own advantages. Where the repository is located at a diocesan level and the objects are then delivered to schools across a WAN the capacity for sharing of 'good practice' lessons is opened up. The protocols for clearly identifying these lessons are in the process of being determined. What has been highlighted so far is the necessity for naming lessons so that they are easily discoverable, not only by the use of clearly identified names but also in terms succinctly described content (meta-metadata!). Associated with this is the need to provide adequate professional development so that the 'good practice' lessons do not become like a series of blackline masters, but rather exemplar lessons that teachers can adapt to their own classrooms through the process of co-creation.

Employing a BELTS box at the school level reduces the ease of sharing 'good practice' but is compensated for by much faster access by busy classrooms providing the problems associated with caching are resolved. (At least this is what seems to be emerging but the full Melbourne trial contrasted with results for Canberra/Goulburn will supply better data on this question). Interestingly, a different type of sharing is emerging. Science objects are being shared between Science classes and English classes, for example. Furthermore, we are now looking at a hybrid model in which clusters of schools share a BELTS box and have boxes located at their own premises. Despite the excitement generated by the objects themselves, students have found the BELTS lesson sequence pages a little bland. To remedy this, a small inter-diocesan group has experimented with generating an improved interface for the sequence pages. Basically, this involves creating a sequence in BELTS, capturing the address of the resulting lesson, feeding this as a query string into a specially constructed page on the commission WAN that uses the objXMLHTTP object to enable re-editing, the addition of background colours, different fonts, the inclusion of graphics, etc. While this process worked well with earlier versions of BELTS, a re-coding in the latest version of BELTS means that a more generic coding of the Commission display page will be needed.

8 REFERENCES

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The Le@rning Federation (200b2) *Learnin*g *Object Size: TLF operational paper 3,* Curriculum Corporation and ***education.au ltd.***

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9 APPENDIX ONE

Report on the trial of Basic E-Learning Tool Set across the Central Schools in the Western Region (Canberra/Goulburn)

Mr Michael Haigh: Canberra/Goulburn Archdiocese

Archdiocese of Canberra and Goulburn

CATHOLIC EDUCATION OFFICE

Technical Report on the trial of the Basic e-Learning Tool Set (BELTS) across the Central Schools in the Western Region of the Archdiocese

Purpose

The Archdiocese of Canberra and Goulburn Catholic Education Office (CGCEO) has participated in a trial of the BELTS application for the deployment of Digital Learning Objects (DLOs) from The Learning Federation (TLF).

The key purpose of this project is to assist in TLF evaluation of stakeholders' understanding of content creation and implementation of the delivery of this content to schools.

> *How does an object from the exchange get to a school and what happens when it gets there? Is a BELTS server better placed at individual school level or is an ASP regional delivery model better?*

The primary area of interest is a trial of BELTS implementation. It will be framed to focus on the issues raised by different implementation models.

Issues such as:

- What level of technical support staff at school/system level is needed?
- What sort of training at school/system level is required of this staff?
- What time needs to be spent in setting up, supporting and maintaining BELTS?
- What are the issues in installing the box onto a network?
- What are the expectations for download times/bandwidth? What are the implications of the actual download time?
- How do the DLOs behave when delivered to schools (i.e. are there any DLO implementation issues)?

As well there are wider issues such as:

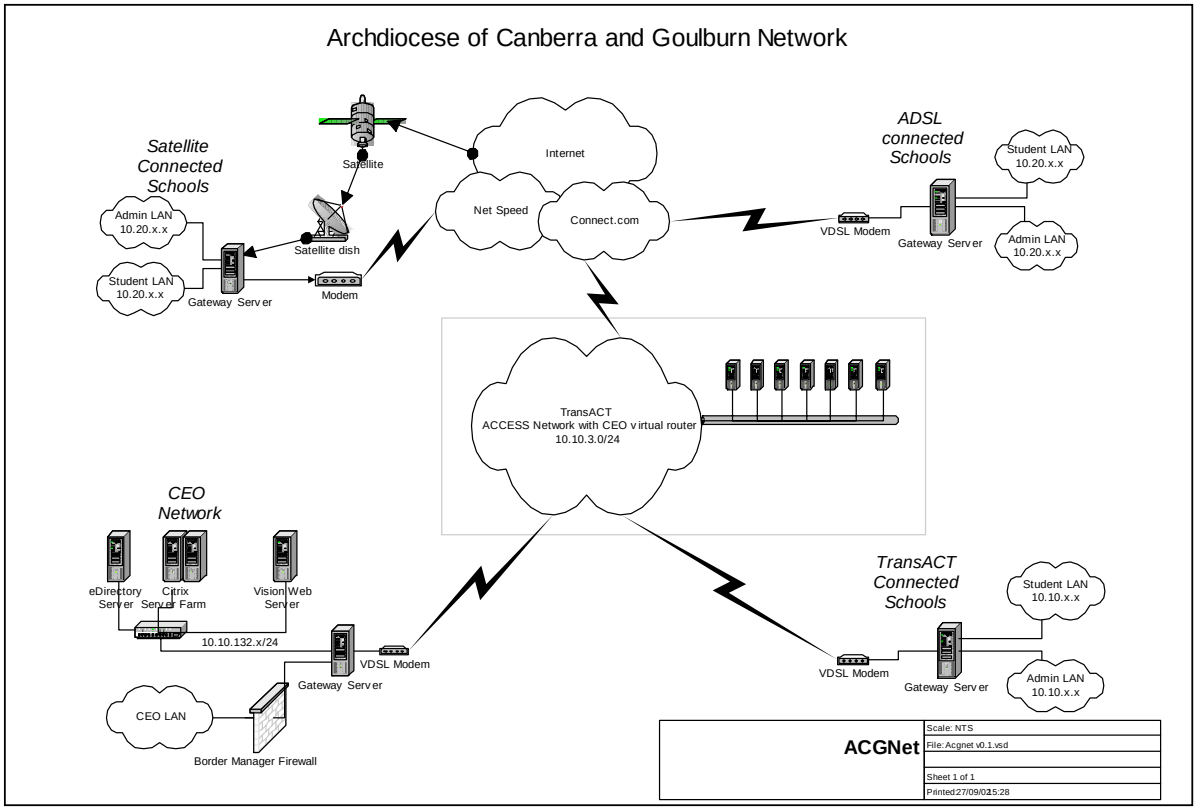
- What are the expected/required professional development needs at a school/system level?
- What technical skills do teachers need to make use of BELTS effectively? What skills and learning/teaching strategies do teachers need to integrate the DLOs into the curriculum?
- How will BELTS be integrated with a Learning Management System and what are the additional costs, management and professional development this brings?

The study will attempt to describe the costs and benefits of and issues associated with the methods trialled. It will provide a report to TLF regarding the outcomes of the trial for the benefit of all stakeholders.

Background

The CGCEO has been in the process of constructing a Wide Area Network (ACGNet) connecting all of its schools across the ACT and South Eastern NSW. The WAN involves central servers located at Dickson and Manuka in Canberra with Gateway Servers in each school. The Central and Gateway Servers are all Linux based servers (Red Hat 7.4) and handle all the traffic out of the schools and into the central management area. The fact that BELTS can be deployed as a Linux service encouraged the CGCEO to participate in the project.

Four NSW Central Schools were selected and agreed to participate in the trial. All of the schools had been connected to ACGNet, were familiar with use of the network and students ranging from Kindergarten to Year 10. This would allow the potential use of DLOs and any of the year levels that they were designed for. All schools have industry standard CAT 5E cabling with managed switches (DLINK DS 3226S/N) controlling their traffic. The Local Area Networks all operate at 100Meg except where the PC card is a 10Meg. The switches are auto-sensing and can handle a range of different Network Interface Cards without impacting on port performance.



Each Linux Gateway server carries out a range of functions. These include:

a firewall to the Internet; proxy services including 1 Gigabyte of Cache; a secure tunnel across the WAN; process monitoring; simple mail transport; local dhcp services; and local Domain Name Services (DNS)

The Local Area Networks at each site are effectively peer-to-peer networks without any LAN level authentication. WAN and Internet access is authenticated against the CGCEO's

myinternet services. All WAN traffic is in the first instance routed through the local proxy. All Internet Traffic is drawn through the CGCEO's central servers

School Profile			
Location	**School**	**Primary students**	**Sec students**
Cootamundra ADSL connection 512k/128k	**Sacred Heart Central School** Principal: Mr Wayne Smith Project contact: Ms Diana Duff Email: Diana.duff@shcoota.cg.catholic.edu.au	162	122
Temora ADSL connection 512k/128k	**St Anne's Central School** Principal: Mr Terry Kennedy Project contact: Ms Debbie Roxburgh Email: debbie.roxburgh@stannes.cg.catholic.edu.au	176	65
Tumut ADSL Connection 512k/128k	**McAuley Catholic Central School** Principal: Mr David Casey Project contact: Ms Joanne Dougherty Email: joanne.dougherty@mcauley.cg.catholic.edu.au	234	138
West Wyalong Satellite Connection 220k/33k	**St Mary's War Memorial School** Principal: Ms Patricia Manglesdorf Project contacts: Mr Andrew Maley Email: maley@smwms.cg.catholic.edu.au And: Ms Peg Seaman Email: peg.seaman@smwms.cg.catholic.edu.au	103	20
Manuka DSSL connection 10M/1M	**Catholic Education Office** Project leader: Michael Haigh Email: michael.haigh@ceo.cangoul.catholic.edu.au Technical Officers: Mark Fritz, Ashley Haigh Education Services Staff: Christine Masters, Thea van Os		

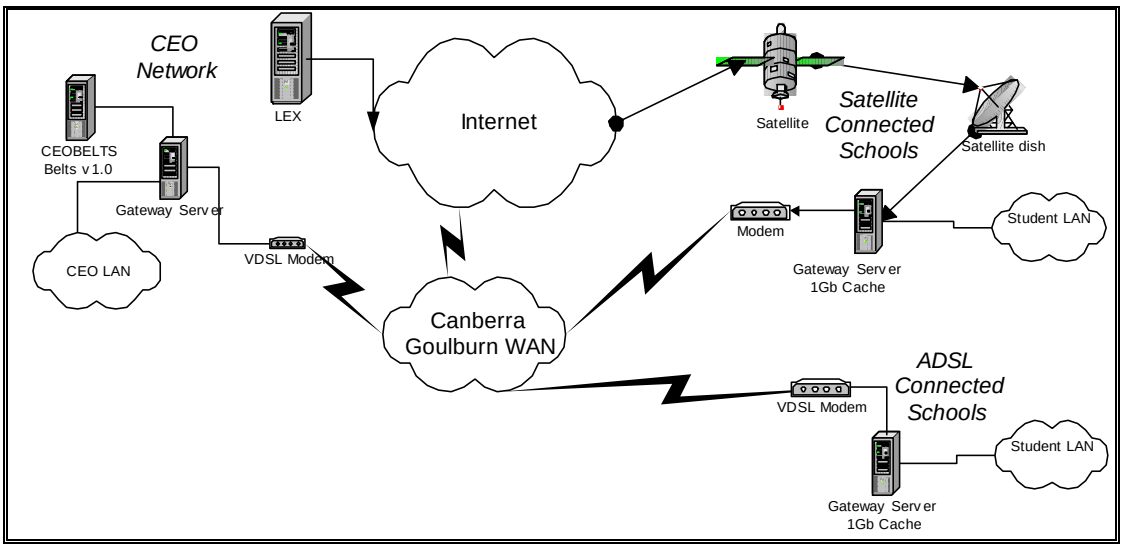
Lake Cargelligo
West Wyalong
Grenfell
WESTERN DEANERY
Temora
Young
Boorowa
Crookwell
Taralga
Murrumburrah
Coota mundra
NORTHERN
North Goulburn
Yass
Goulburn
Gundagai
DEANERY
CANBERRA
Adelong
Tumut
Batlow
CENTRAL DEANERY
Queanbeyan
Braidwood
Batehaven
Broulee
Moruya
MONARO
Cooma
COASTAL
DEANERY
DEANERY
Bega
Bombala
Pambula
Eden
VICTORIAN BORDER
Primary School K-6
Central School K-10
Secondary School 7-12
ARCHDIOCESE OF
CANBERRA AND GOULBURN
LOCATION OF NEW SOUTH WALES SCHOOLS

Methodology

Phase 1.

2 Sept 2003 – 28 Nov

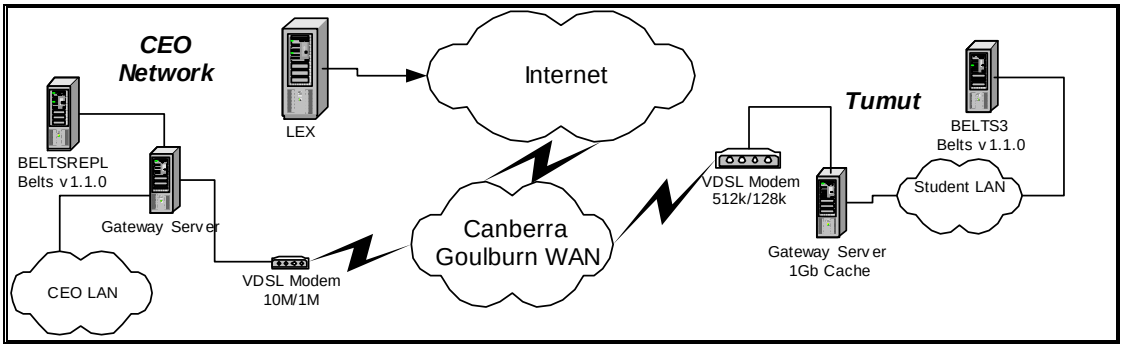
Initially BELTS was only available in a non-replicating mode. A separate server was configured to run BELTS v1.0 and made available across ACGNet. The server was identified as CEOBELTS (*belts.cg.catholic.edu.au*) and was deployed at Manuka. Training was run at Cootamundra and all schools were encouraged to explore and construct lessons.



Phase 2.

20 Sept to 28 Nov

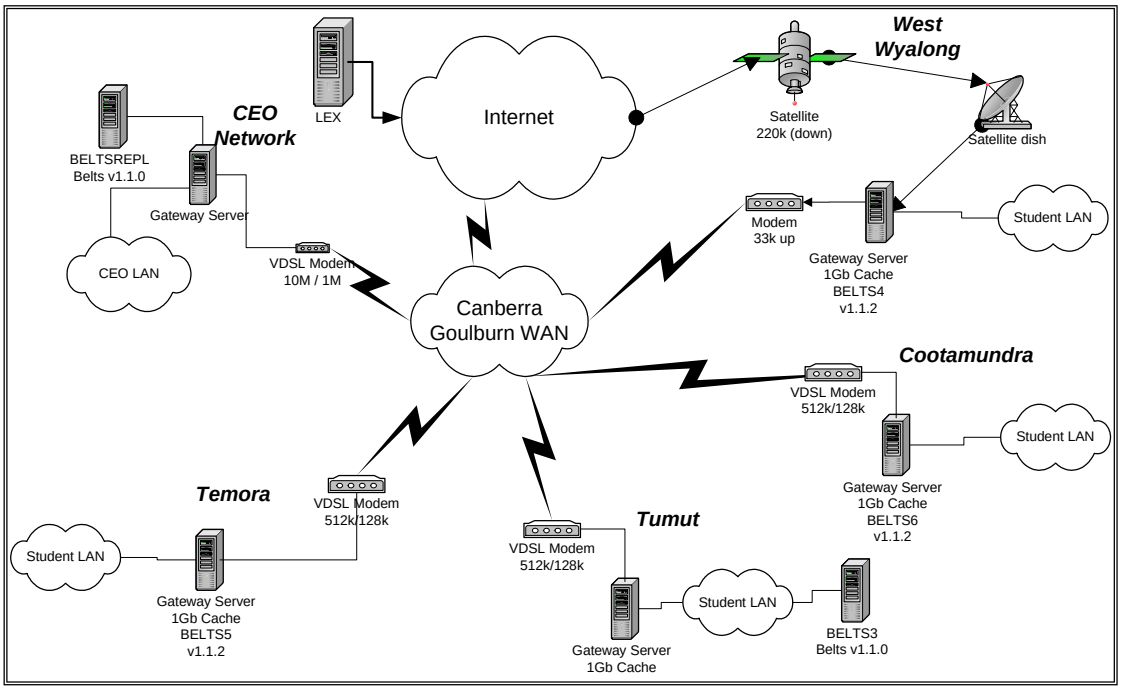
Following the release of the replication capable version of BELTS (v1.1.0), two separate servers were setup. One server, BELTSREPL, (beltsrepl.cg.catholic.edu.au) was configured as the Central Server to collect objects from the Learning Exchange and make them available for deployment. The second server BELTS3 (*belts3.cg.catholic.edu.au*) was configured as the downstream server obtaining DLOs from beltsrepl. Initially this was setup in a test environment at Manuka to verify connectivity. Following satisfactory testing BELTS3 was moved to Tumut and the remaining DLOs were downloaded. The server was given an internally name of *belts.mcauley.acgnet* to make it easily identified within the CGCEO WAN. Lessons were now able to be constructed locally.



Phase 3

18 Oct to 28 Nov

Following the satisfactory operation of BELTS3 in Tumut, a deployment of the BELTS v1.1.2 application within a local gateway at West Wyalong was achieved (BELTS4). The install was carried using a self install cd developed within the CGCEO. The service was given an internal name of *belts.smwms.acgnet* and needed to operate on port 2020 as port 8080 was already being used by the proxy service on the gateway. The success of this deployment led to successful installations within Temora (BELTS5) and Cootamundra (BELTS6). These were identified as *belts.stannes.acgnet* and *belts.shcoota.acgnet*.



Learning objects are drawn from LEX by BELTSREPL. These are then published manually. They are then pulled by each of the servers located in Cootamundra, Tumut, Temora and West Wyalong. Automation of the process has not been tested at this point. Recent objects released on 28 November 2003 took approximately 3 and a half minutes to be pulled from Manuka to Cootamundra over the 512k ADSL link. The same process took 9 minutes over the satellite link to West Wyalong. The collection of the objects from LEX took approximately 10 minutes across the internet.

The collection process is not seamless. The following steps were required:

Login as a manager

Select *Administration>*

Retrieve objects from a learning object provider:

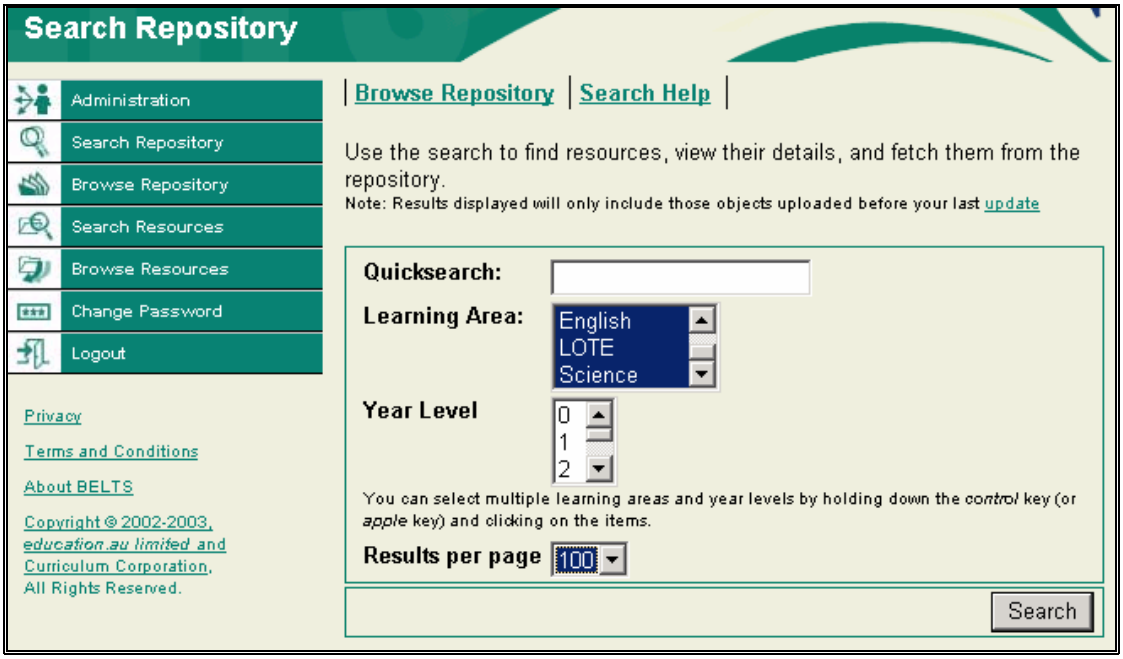
Select *belts* or *exchange*

(if a downstream server select belts if main replication server select exchange)

Wait for collection of xml content from provider

Select *Search Repository*

Search for all content not already collected (Highlight all Learning Areas) set the page for 100 objects as the default of 20 may mean multiple pages



When the items are returned Check those that are wanted and select Download. The objects will be placed in a queue and will arrive at some future time dependant on bandwidth.

Following arrival of the objects the need to be published inorder that teachers may see them. This is achieved by *Search Resources* across all areas again looking for those that have not been published (as shown below).

Select each item to be published and click *Publish*. Again note that selecting 100 items gives a better chance of hitting all objects at once. There are some significant management issues here for a deployment of 50 plus schools each with their own local BeLTS server. An auto pull

and publish function built into the jboss-services.xml would be appreciated by deployments such as the CGCEO. This should be configurable on the downstream servers but not available from the exchange.

Server Specifications

Server general name	CEOBELTS
OS	Linux Red Hat 7.3
Belts version	V1.0
External URL	Belts.cg.catholic.edu.au
Internal URL	Belts.ceo.acgnet
Location	Manuka
Supplier	Dell
Model	600sc
Approximate cost	$3300
CPU	Pentium 4 2.4 Ghz
Memory	512MB ECC DDR RAM
Storage (Hard Disk)	80Gb IDE
NIC	100MHz
WAN connection	ADSL 10M/1M

Server general name	BELTSREPL
OS	Linux Red Hat 7.3
Belts version	V1.1.0
External URL	Beltsrepl.cg.catholic.edu.au
Internal URL	Beltsrepl.ceo.acgnet
Location	Manuka
Supplier	IBM
Model	Netvista
Approximate cost	$2300
CPU	Pentium 4 1.6 Ghz
Memory	512MB SD RAM
Storage (Hard Disk)	36Gb IDE

NIC	100MHz
WAN connection	ADSL 10M/1M

Server general name	BELTS3
OS	Linux Red Hat 7.3
Belts version	V1.1.0
External URL	Belts3.cg.catholic.edu.au
Internal URL	Belts.mcauley.acgnet
Location	Tumut
Supplier	IBM
Model	Netvista
Approximate cost	$2300
CPU	Pentium 4 1.6 Ghz
Memory	512MB SD RAM
Storage (Hard Disk)	36Gb IDE
NIC	100MHz
WAN connection	ADSL 512k/128k

Server general name	BELTS4
OS	Linux Red Hat 7.3
Belts version	V1.1.2
External URL	Belts4.cg.catholic.edu.au
Internal URL	Belts.smwms.acgnet
Location	West Wyalong
Supplier	Dell
Model	14000sc
Approximate cost	$3300
CPU	Pentium 3 1.26Ghz
Memory	512MB ECC DDR RAM
Storage (Hard Disk)	80Gb IDE
NIC	100MHz

WAN connection	Satellite/Modem 250k/33k

Server general name	BELTS5
OS	Linux Red Hat 7.3
Belts version	V1.1.2
External URL	Belts5.cg.catholic.edu.au
Internal URL	Belts.stannes.acgnet
Location	Temora
Supplier	Dell
Model	14000sc
Approximate cost	$3300
CPU	Pentium 3 1.26Ghz
Memory	512MB ECC DDR RAM
Storage (Hard Disk)	80Gb IDE
NIC	100MHz
WAN connection	ADSL 512k/128k

Server general name	BELTS6
OS	Linux Red Hat 7.3
Belts version	V1.1.2
External URL	Belts6.cg.catholic.edu.au
Internal URL	Belts.shcoota.acgnet
Location	Cootamundra
Supplier	Dell
Model	600sc
Approximate cost	$3300
CPU	Pentium 4 2.4 Ghz
Memory	512MB ECC DDR RAM
Storage (Hard Disk)	80Gb IDE
NIC	100MHz
WAN connection	ADSL 512k/128k

Issues

Expertise

The two Technical Officers from the CGCEO are in their early 20s and have significant Linux expertise. Mark also has significant scripting expertise.

CEOBELTS took half a day to build as a Linux box with the CGCEO standard gateway image. It took several days to iron out operational issues to get the belts service to run on the linux server. The final step involved the sending of the jboss-services.xml file to TLF for adjustment. Following the return of this a connection was able to be achieved and DLOs retrieved from LEX.

BELTSREPL was built using version 1.1.0 of the software and a lower end workstation. The service would not come up until there was 512Mb of RAM on board. BELTS3 was built on the local subnet using the same hardware and software version configuration. The jboss-services.xml file was configured according to the documentation as a downstream server and was able to connect to BELTSREPL to retrieve DLOs.(see code fragment) The process took approximately 4 hours to build each server to WAN bootable status. A further 2 hours was required to install BELTS and associated services and have these all activated. This required the skills of a person very familiar with Linux system administration and scripting.

The relocation of BELTS3 from the local subnet to the Tumut subnet was relatively simple requiring a change of ip address for the server. The location of the up-line proxy was also needed. These are minor Domain Name Service issues that would need addressing for any similar server relocation.

Jboss-services.xml code fragment

```
      <!-- BELTS Provider -->
      <mbean
code="au.edu.educationau.belts.management.provider.ProviderService"
name="belts:service=Provider,name=belts">
            <depends>belts:service=ContentStore</depends>
            <depends>belts:service=HttpClientPool</depends>

            <attribute
name="JndiName">belts/content/provider/belts</attribute>

            <attribute
name="ProviderClass">au.edu.educationau.belts.content.BeltsProvider</
attribute>
            <attribute name="Configuration">
                  <![CDATA[<belts id="belts"
url="http://provider.domain/provide/" username="user_name"
password="password"/>]]>
            </attribute>
      </mbean>
```

Configuration of the Gateway servers was assisted by the creation of an auto-install disk. The disk is mounted within the Linux server and the installation script is run. This script installs Postgress and Java, starts the postgress service, creates the belts user within postgress. It then installs BELTS and creates the BELTS service. Manual configuration is required to change the operation port to 2020 rather than 8080 as this is used by the server for the Squid proxy service. This is documented in the BELTS Installation guide (pg 10). The auto-install process takes about 20 minutes including the change to the jboss-service.xml files. (2 different files in 2 different locations but the same name).

After the successful install, BELTS needs to be bootstrapped to be loaded with core data and base users. This takes about 5 minutes as long as the files core-data.xml and test-data.xml are available on the local file system. Copies were placed on the auto-install CD. Following a successful import of the bootstrap data, DLOs can be obtained from the upstream BELTS server. This process takes about 10 minutes to setup with a period of something like 15 minutes for the actual DLOs to be queued and loaded locally. This is obviously bandwidth dependant as well as number of DLO dependant as well. Knowledge of the BELTS processes is required not any other particular ICT competence. An already operational Linux Red Hat server can be made BELTS operational within an hour and, depending on the number of objects to be downloaded, may be teacher ready within a couple of hours. Should the installation not proceed smoothly the time taken to resolve the problems will be dependant on the nature of the problem and the availability of suitably competent Linux Technical Support.

Learning Objects operation on workstations

Software

Local Software setup (Flash 6 and Shockwave 8.5)

Allow 1 day per school

XP specific issues:

Shockwave will not install automatically

Flash 6 will not install over Flash5.5

Solutions:

Shockwave

Download full shockwave installer (for Netscape but works for IE). Locate this on a server at the school and use it to install across all PC platforms. (98/ME/2K/XP)

Each install requires a registration. (select the under 13 option and you do not have to complete all of the registration details)

Flash 6

Download the Flash uninstaller. Execute this for all XP machines and then install Flash 6 from Macromedia.

This process takes about 5 minutes per machine once everything has been setup ie downloaded from Macromedia and installed on a central server.

A lesson that involves the execution of Flash 6, Shockwave and other objects with sound was created. This was then used as a test to verify that the software was working. This process takes about 10 minutes per machine but guarantees operation with most objects. A suitable set identified by TLF would be appreciated.

Hardware / Operating System Issues

Many of the DLOs have Windows 2000 as a minimum operating system requirement. The CGCEO has Windows 98 Second Edition as a current minimum specification (out of necessity). The lowest level machine that was successfully used was a Pentium 1 with 64Mb of RAM and Internet Explorer 5.5. Smaller objects load and execute quite well but larger objects such as Finders Keepers will load but do not operate in a satisfactory manner. The preferred machine across all 4 sites was a Pentium 4 with 256Mb RAM and XP Pro and IE 6. Finders Keepers runs extremely well on such a machine.

Cache

All objects cached within the CGCEO Proxy Servers built on the above Dell servers. These have SQUID as the proxy and have 1Gbyte allocated as the store. The object could take up to a minute to load the first time but subsequent access on separate machines using the same proxy occurred within 10 seconds.

Below are extracts from /var/log/squid/access.log (swf cache hits and all hits for the call of the objects Finders Keepers.)

A quick guide for interpretation:

TCP_MISS:FIRST_PARENT_MISS	Miss by both local proxy and its parent
TCP_MISS:FIRST_UP_PARENT	Miss by local proxy, hit by parent
TCP_HIT:NONE	Hit by local proxy from disk cache
TCP_MEM_HIT:NONE	Hit by local proxy from memory cache (smaller objects)
TCP_IMS_HIT:NONE	Client Browser IF_MODIFIED_SINCE http directive cache hit

Summary of Access.log for swf object (Wind Power)

```
10.10.138.223 - - [25/Nov/2003:14:40:21 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
2/LO_04/20030228/LO_04.swf HTTP/1.0" 200 52837
TCP_MISS:FIRST_UP_PARENT

10.10.138.223 - - [25/Nov/2003:14:40:33 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
2/LO_04/20030228/LO_04_rt.swf HTTP/1.0" 200 3932
TCP_MISS:FIRST_PARENT_MISS

10.10.138.223 - - [25/Nov/2003:14:40:34 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
2/LO_04/20030228/LO_04_gl.swf HTTP/1.0" 200 13945
TCP_MISS:FIRST_UP_PARENT

10.10.138.223 - - [25/Nov/2003:14:40:37 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
2/LO_04/20030228/LO_04_test.swf HTTP/1.0" 200 29023
TCP_MISS:FIRST_PARENT_MISS

10.10.138.223 - - [25/Nov/2003:14:52:51 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
2/LO_04/20030228/LO_04.swf HTTP/1.0" 304 223 TCP_IMS_HIT:NONE
```

```
10.10.138.223 - - [25/Nov/2003:14:53:03 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
4/LO_05/20030228/LO_05.swf HTTP/1.0" 200 52895
TCP_MISS:FIRST_UP_PARENT

10.10.138.223 - - [25/Nov/2003:14:53:15 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
4/LO_05/20030228/LO_05_rt.swf HTTP/1.0" 200 4150
TCP_MISS:FIRST_UP_PARENT

10.10.138.223 - - [25/Nov/2003:14:53:16 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
4/LO_05/20030228/LO_05_gl.swf HTTP/1.0" 200 14835
TCP_MISS:FIRST_PARENT_MISS

10.10.139.250 - - [25/Nov/2003:14:53:33 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
2/LO_04/20030228/LO_04.swf HTTP/1.0" 200 52847 TCP_HIT:NONE

10.10.139.250 - - [25/Nov/2003:14:53:44 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
2/LO_04/20030228/LO_04_rt.swf HTTP/1.0" 200 3942 TCP_MEM_HIT:NONE

10.10.139.250 - - [25/Nov/2003:14:53:44 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
2/LO_04/20030228/LO_04_gl.swf HTTP/1.0" 200 13955 TCP_HIT:NONE

10.10.139.250 - - [25/Nov/2003:14:53:45 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
2/LO_04/20030228/LO_04_test.swf HTTP/1.0" 200 29033 TCP_HIT:NONE

10.10.139.250 - - [25/Nov/2003:14:53:56 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
4/LO_05/20030228/LO_05.swf HTTP/1.0" 200 52904 TCP_HIT:NONE

10.10.139.250 - - [25/Nov/2003:14:54:06 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
4/LO_05/20030228/LO_05_rt.swf HTTP/1.0" 200 4159 TCP_MEM_HIT:NONE

10.10.139.250 - - [25/Nov/2003:14:54:06 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
4/LO_05/20030228/LO_05_gl.swf HTTP/1.0" 200 14844 TCP_HIT:NONE

10.10.138.223 - - [25/Nov/2003:14:54:28 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
2/LO_04/20030228/LO_04_rt.swf HTTP/1.0" 304 223 TCP_IMS_HIT:NONE

10.10.138.223 - - [25/Nov/2003:14:54:28 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
2/LO_04/20030228/LO_04_gl.swf HTTP/1.0" 304 223 TCP_IMS_HIT:NONE

10.10.138.223 - - [25/Nov/2003:14:54:28 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV49
2/LO_04/20030228/LO_04_test.swf HTTP/1.0" 304 223 TCP_IMS_HIT:NONE
```

Summary of Access for dcr object (Finders Keepers 1)

```
1068591497.571    735 10.20.178.116 TCP_MISS/200 1815 GET

http://belts.cg.catholic.edu.au/lesson/mh_fk2/view/1.html -

FIRST_UP_PARENT/proxy.smwms.cg.catholic.edu.au text/html

1068591497.698      0 10.20.178.116 TCP_MEM_HIT/200 1776 GET

http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qan
tm_015_release/index.html - NONE/- text/html

1068591497.793      4 10.20.178.116 TCP_MEM_HIT/200 838 GET
http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qan
tm_015 release/js/script.js - NONE/- application/x-javascript

1068591497.905     16 10.20.178.116 TCP_MEM_HIT/200 655 GET

http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qan
tm_015 release/css/styles.css - NONE/- text/css

1068591497.913      6 10.20.178.116 TCP_MEM_HIT/200 1361 GET

http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qan
tm_015_release/TLF_Logo.jpg - NONE/- image/jpeg

1068591498.826    447 10.20.178.116 TCP_HIT/200 172318 GET

http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qan
tm_015_release/loader.dcr - NONE/- application/x-director

1068591506.628     19 10.20.178.116 TCP_MEM_HIT/200 3918 GET

http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qan
tm_015_release/dswmedia/images/preloader_next.jpg - NONE/- image/jpeg


1068591508.860   1921 10.20.178.116 TCP_HIT/200 2163053 GET
http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qan
tm_015_release/house.dcr - NONE/- application/x-director

1068591535.701   1050 10.20.178.116 TCP_HIT/200 31401 GET

http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qan
tm_015_ release/dswmedia/images/interface_white.jpg - NONE/-
image/jpeg
```

Detailed Access log for .swf objects (Wind Power LO_04 and LO_05)

Request for Learning Object 4

First time called

```
10.10.138.223 - - [25/Nov/2003:14:40:21 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV492/LO_04/20030228/
LO_04.swf HTTP/1.0" 200 52837 TCP_MISS:FIRST_UP_PARENT
```

Get the LO_04.swf from the source – not available from the proxy or its parent (upstream proxy)

```
10.10.138.223 - - [25/Nov/2003:14:40:33 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV492/LO_04/20030228/
LO_04_rt.swf HTTP/1.0" 200 3932 TCP_MISS:FIRST_PARENT_MISS
```

Get the LO_04RT.swf from the source – not available from the proxy or its parent (upstream proxy)

10.10.138.223 - - [25/Nov/2003:14:40:34 +1100] "GET http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV492/LO_04/20030228/LO_04_gl.swf HTTP/1.0" 200 13945 TCP_MISS:FIRST_UP_PARENT

Get the LO_04_gl.swf from the source – not available from the proxy or its parent (upstream proxy)

```
10.10.138.223 - - [25/Nov/2003:14:40:37 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV492/LO_04/20030228/
LO_04_test.swf HTTP/1.0" 200 29023 TCP_MISS:FIRST_PARENT_MISS
```

Get the LO_04_test.swf from the source – not available from the proxy or its parent (upstream proxy)

LO_04 Second time called

```
10.10.138.223 - - [25/Nov/2003:14:52:51 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV492/LO_04/20030228/
LO_04.swf HTTP/1.0" 304 223 TCP_IMS_HIT:NONE
```

Get the LO_04.swf from the browsers' cache

Request for Learning Object 5

```
10.10.138.223 - - [25/Nov/2003:14:53:03 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV494/LO_05/20030228/
LO_05.swf HTTP/1.0" 200 52895 TCP_MISS:FIRST_UP_PARENT
```

Get the LO_05.swf from the source – not available from the proxy or its parent (upstream proxy)

```
10.10.138.223 - - [25/Nov/2003:14:53:15 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV494/LO_05/20030228/
LO_05_rt.swf HTTP/1.0" 200 4150 TCP_MISS:FIRST_UP_PARENT
```

Get the LO_05_rt.swf from the source – not available from the proxy or its parent (upstream proxy)

```
10.10.138.223 - - [25/Nov/2003:14:53:16 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV494/LO_05/20030228/
LO_05_gl.swf HTTP/1.0" 200 14835 TCP_MISS:FIRST_PARENT_MISS
```

Get the LO_05_gl.swf from the source – not available from the proxy or its parent (upstream proxy)

Request for Learning Object 4 from new machine (ip 10.10.139.250)

```
10.10.139.250 - - [25/Nov/2003:14:53:33 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV492/LO_04/20030228/
LO_04.swf HTTP/1.0" 200 52847 TCP_HIT:NONE
```

Get the LO_04.swf from the local cache

```
10.10.139.250 - - [25/Nov/2003:14:53:44 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV492/LO_04/20030228/
LO_04_rt.swf HTTP/1.0" 200 3942 TCP_MEM_HIT:NONE
```

Get the LO_04_rt.swf from the local memory cache

```
10.10.139.250 - - [25/Nov/2003:14:53:44 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV492/LO_04/20030228/
LO_04_gl.swf HTTP/1.0" 200 13955 TCP_HIT:NONE
```

Get the LO_04_gl.swf from the local disk cache

```
10.10.139.250 - - [25/Nov/2003:14:53:45 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV492/LO_04/20030228/
LO_04_test.swf HTTP/1.0" 200 29033 TCP_HIT:NONE
```

Get the LO_04_test.swf from the local disk cache

Request for Learning Object 5 from new machine (ip 10.10.139.250)

```
10.10.139.250 - - [25/Nov/2003:14:53:56 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV494/LO_05/20030228/
LO_05.swf HTTP/1.0" 200 52904 TCP_HIT:NONE
```

Get the LO_05.swf from the local disk cache

```
10.10.139.250 - - [25/Nov/2003:14:54:06 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV494/LO_05/20030228/
LO_05_rt.swf HTTP/1.0" 200 4159 TCP_MEM_HIT:NONE
```

Get the LO_05_rt.swf from the local memory cache

```
10.10.139.250 - - [25/Nov/2003:14:54:06 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV494/LO_05/20030228/
LO_05_gl.swf HTTP/1.0" 200 14844 TCP_HIT:NONE
```

Get the LO_05_gl.swf from the local disk cache

Request for Learning Object 4 from original machine (10.10.138.223)

```
10.10.138.223 - - [25/Nov/2003:14:54:28 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV492/LO_04/20030228/
LO_04_rt.swf HTTP/1.0" 304 223 TCP_IMS_HIT:NONE
```

Get the LO_04_rt.swf from the browsers'l cache

```
10.10.138.223 - - [25/Nov/2003:14:54:28 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV492/LO_04/20030228/
LO_04_gl.swf HTTP/1.0" 304 223 TCP_IMS_HIT:NONE
```

Get the LO_04_gl.swf from the browsers' cache

```
10.10.138.223 - - [25/Nov/2003:14:54:28 +1100] "GET
http://belts3.cg.catholic.edu.au/content/exchange/76/3.0/Content/LV492/LO_04/20030228/
LO_04_test.swf HTTP/1.0" 304 223 TCP_IMS_HIT:NONE
```

Get the LO_04_test.swf from the browsers' cache

Access Log for dcr object (Finders Keepers 1)

The first requests are for the lesson page (mh_fk2/view/l.html) and the object's index.html page which is followed by the java script script.js and the cascading style sheet styles.css andf the TLF logo. The lesson page is retrieved from squid disk cache with all the others retrieved from memory cache. Then the object is requested (loader.dcr)

```
1068591497.571    735 10.20.178.116 TCP_MISS/200 1815 GET
http://belts.cg.catholic.edu.au/lesson/mh_fk2/view/1.html -
FIRST_UP_PARENT/proxy.smwms.cg.catholic.edu.au text/html
```

```
1068591497.698      0 10.20.178.116 TCP_MEM_HIT/200 1776 GET
http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qantm_015_release/in
dex.html - NONE/- text/html
```

```
1068591497.793      4 10.20.178.116 TCP_MEM_HIT/200 838 GET
http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qantm_015
release/js/script.js - NONE/- application/x-javascript
```

```
1068591497.905     16 10.20.178.116 TCP_MEM_HIT/200 655 GET
http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qantm_015
release/css/styles.css - NONE/- text/css
```

```
1068591497.913      6 10.20.178.116 TCP_MEM_HIT/200 1361 GET
http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qantm_015_release/TL
F_Logo.jpg - NONE/- image/jpeg
```

Request for Finders Keepers loader.dcr

```
1068591498.826    447 10.20.178.116 TCP_HIT/200 172318 GET
http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qantm_015_release/lo
ader.dcr - NONE/- application/x-director
```

Get the loader.dcr from the local disk cache

```
1068591506.628     19 10.20.178.116 TCP_MEM_HIT/200 3918 GET
http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qantm_015_release/ds
wmedia/images/preloader_next.jpg - NONE/- image/jpeg
```

Get the preloader_next.jpg from the local memory cache

```
1068591508.860   1921 10.20.178.116 TCP_HIT/200 2163053 GET
http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qantm_015_release/ho
use.dcr - NONE/- application/x-director
```

Get the house.dcr from the local disk cache

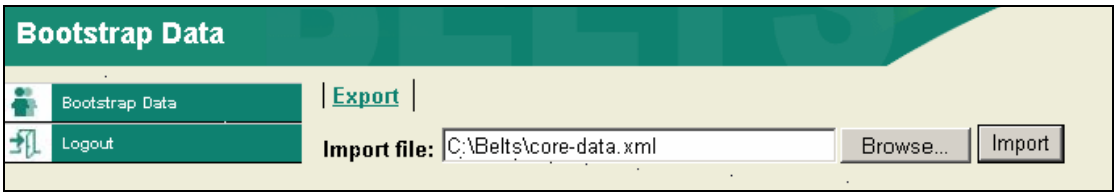
```
1068591535.701   1050 10.20.178.116 TCP_HIT/200 31401 GET
http://belts.cg.catholic.edu.au/content/262/Content/LV1630/li_001_qantm_015_
release/dswmedia/images/interface_white.jpg - NONE/- image/jpeg
```

Get the interface_white.jpg from the local disk cache

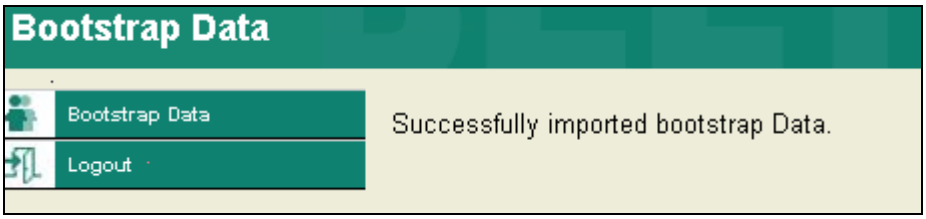
Belts Bootstrap Procedures

Login in as <bootstrap> pwd <bootstrap> or what you have changed it to.

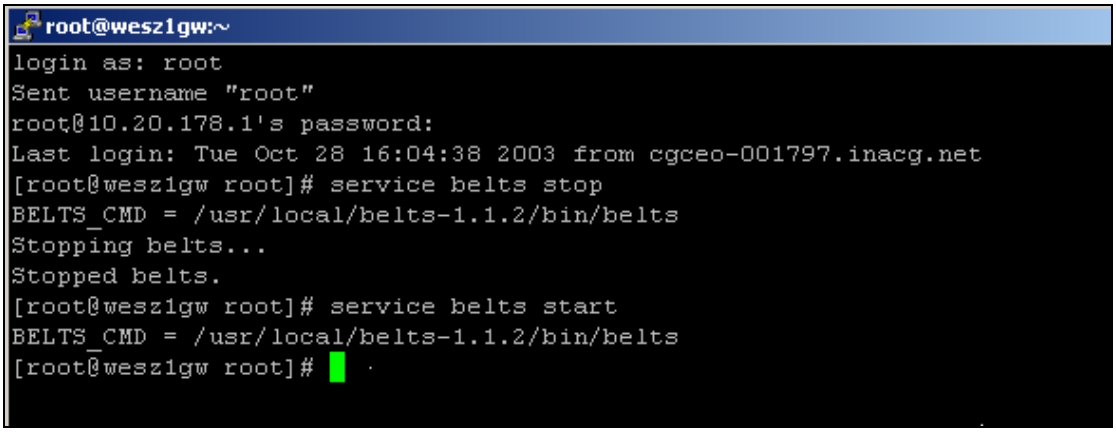
Load the core data (from quick install cd) or copy down using winscp.exe if you do not have it locally.



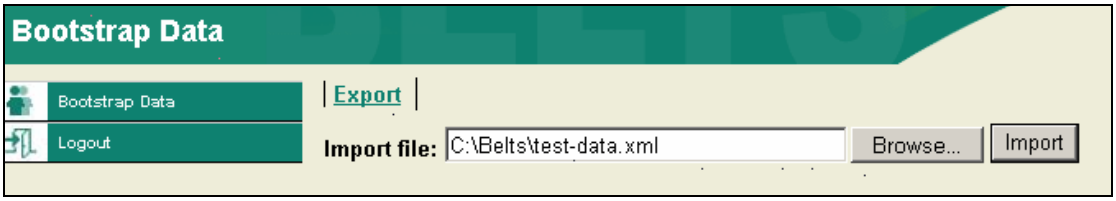
If the load is successful a message is returned



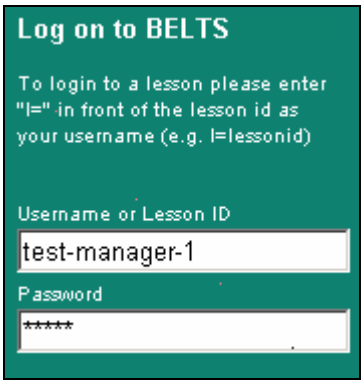
If the data will not load then stop the belts service and restart it: (known bug?)



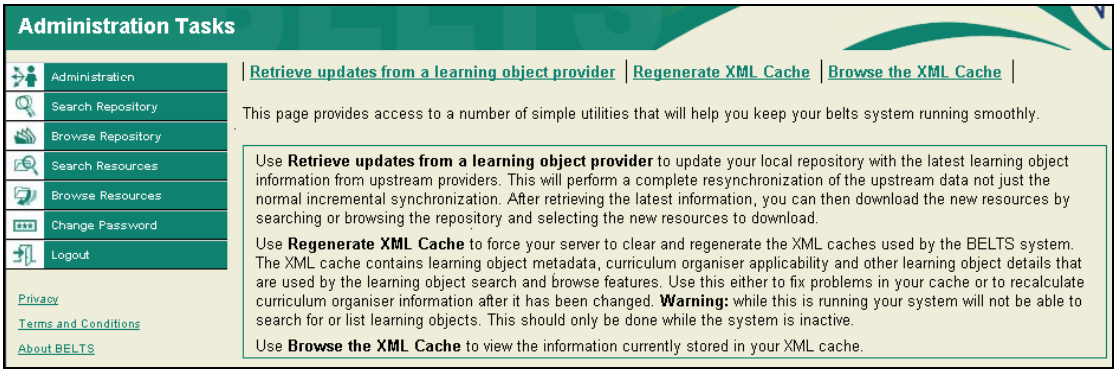
Import the test-data with the users in it



Logout and login as the test-manager-1


Log on to BELTS
To login to a lesson please enter "l=" in front of the lesson id as your username (e.g. l=lessonid)
Username or Lesson ID
test-manager-1
Password
*****

Select Administration and then Retrieve updates…

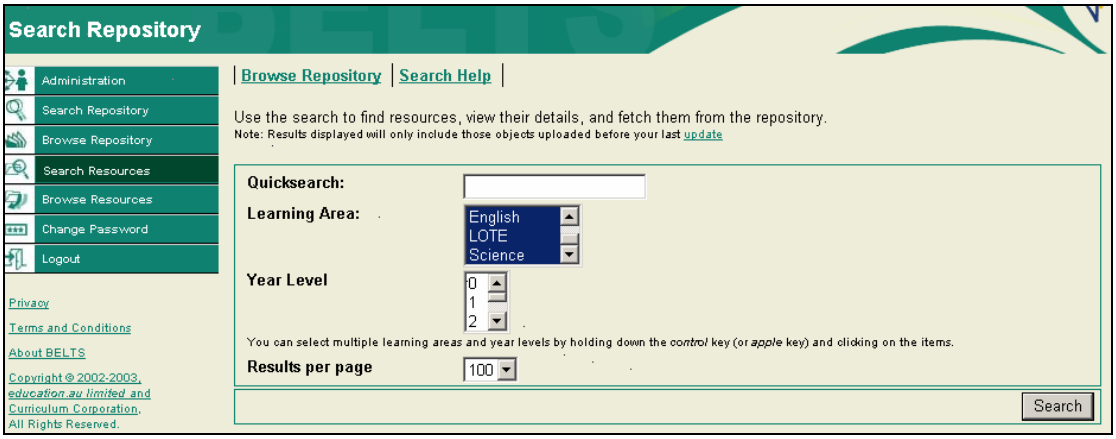

Administration Tasks
Administration
Search Repository
Browse Repository
Search Resources
Browse Resources
Change Password
Logout
Privacy
Terms and Conditions
About BELTS
Retrieve updates from a learning object provider
Regenerate XML Cache
Browse the XML Cache
This page provides access to a number of simple utilities that will help you keep your belts system running smoothly.
Use Retrieve updates from a learning object provider to update your local repository with the latest learning object information from upstream providers. This will perform a complete resynchronization of the upstream data not just the normal incremental synchronization. After retrieving the latest information, you can then download the new resources by searching or browsing the repository and selecting the new resources to download.
Use Regenerate XML Cache to force your server to clear and regenerate the XML caches used by the BELTS system. The XML cache contains learning object metadata, curriculum organiser applicability and other learning object details that are used by the learning object search and browse features. Use this either to fix problems in your cache or to recalculate curriculum organiser information after it has been changed. Warning: while this is running your system will not be able to search for or list learning objects. This should only be done while the system is inactive.
Use Browse the XML Cache to view the information currently stored in your XML cache.

Select the belts provider. You will need to have a provider configured in the jboss-service.xml configuration file with an appropriate provider, username and password

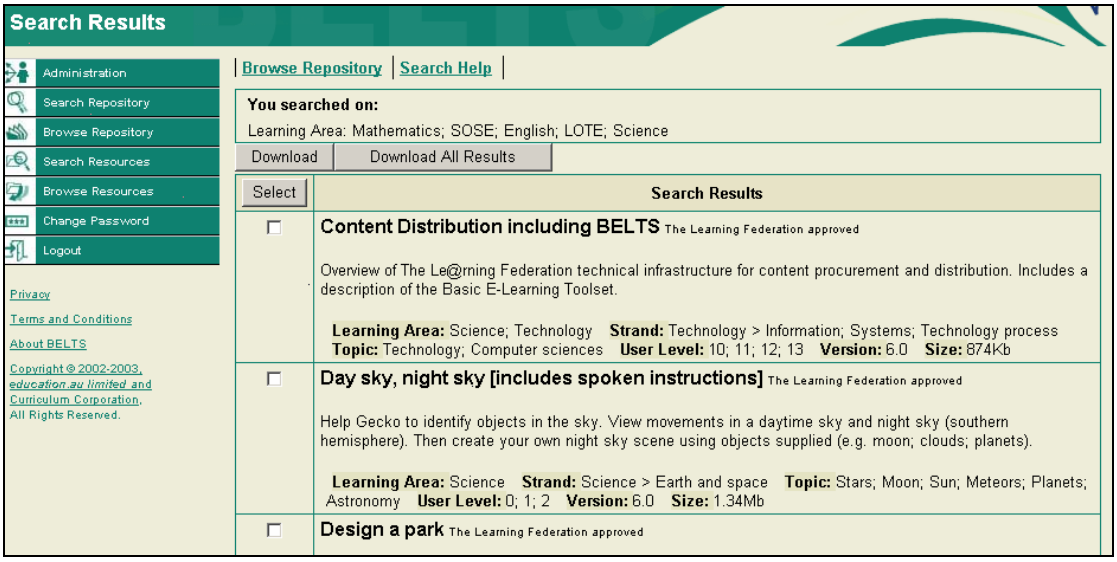
```
<!-- BELTS Provider -->
<mbean code="au.edu.educationau.belts.management.provider.ProviderService"
name="belts:service=Provider,name=belts">
    <depends>belts:service=ContentStore</depends>
    <depends>belts:service=HttpClientPool</depends>
    <attribute name="JndiName">belts/content/provider/belts</attribute>
    <attribute
name="ProviderClass">au.edu.educationau.belts.content.BeltsProvider</attribute>
    <attribute name="Configuration">
        <![CDATA[<belts id="belts" url="http://provider.domain/provide/"
username="user_name" password="password"/>]]>
```

```
            </attribute>
        </mbean>
```

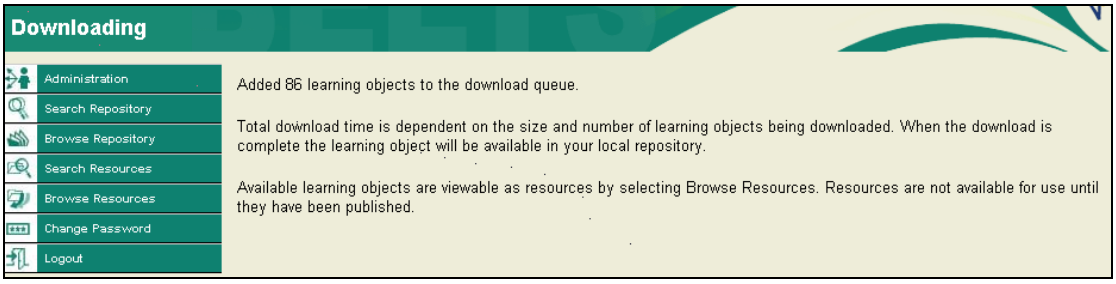
Search the Repository to get a list of the available objects



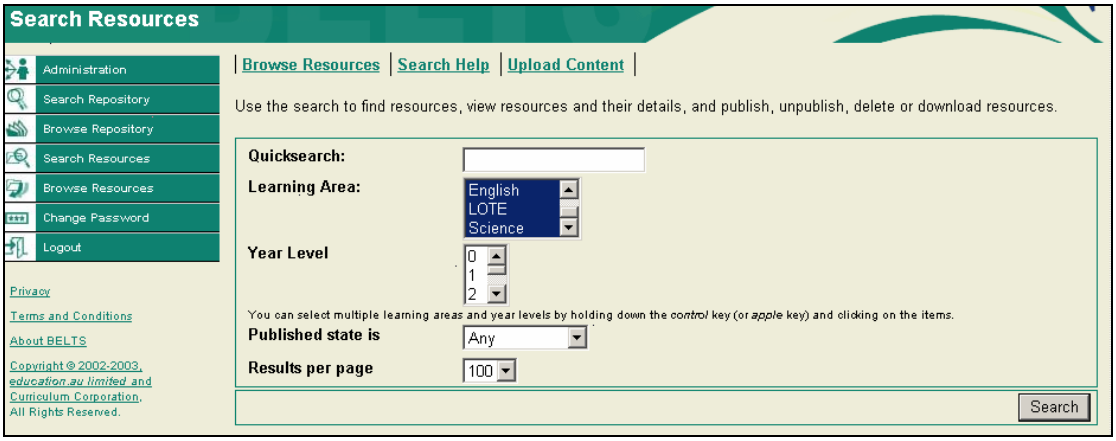
And then <Download All Results> to get the objects displayed on the page


Search Results
Administration
Search Repository
Browse Repository
Search Resources
Browse Resources
Change Password
Logout
Privacy
Terms and Conditions
About BELTS
Copyright © 2002-2003, education.au limited and Curriculum Corporation, All Rights Reserved.
Browse Repository
Search Help
You searched on:
Learning Area: Mathematics; SOSE; English; LOTE; Science
Download
Download All Results
Select
Search Results
Content Distribution including BELTS The Learning Federation approved
Overview of The Le@rning Federation technical infrastructure for content procurement and distribution. Includes a description of the Basic E-Learning Toolset.
Learning Area: Science; Technology Strand: Technology > Information; Systems; Technology process
Topic: Technology; Computer sciences User Level: 10; 11; 12; 13 Version: 6.0 Size: 874Kb
Day sky, night sky [includes spoken instructions] The Learning Federation approved
Help Gecko to identify objects in the sky. View movements in a daytime sky and night sky (southern hemisphere). Then create your own night sky scene using objects supplied (e.g. moon; clouds; planets).
Learning Area: Science Strand: Science > Earth and space Topic: Stars; Moon; Sun; Meteors; Planets; Astronomy User Level: 0; 1; 2 Version: 6.0 Size: 1.34Mb
Design a park The Learning Federation approved

The object will then be placed in a queue


Downloading
Administration
Search Repository
Browse Repository
Search Resources
Browse Resources
Change Password
Logout
Added 86 learning objects to the download queue.
Total download time is dependent on the size and number of learning objects being downloaded. When the download is complete the learning object will be available in your local repository.
Available learning objects are viewable as resources by selecting Browse Resources. Resources are not available for use until they have been published.

The objects are now available as resources but need to be published



Search Results
Administration
Search Repository
Browse Repository
Search Resources
Browse Resources
Change Password
Logout
Privacy
Terms and Conditions
About BELTS
Copyright © 2002-2003, education.au limited and Curriculum Corporation. All Rights Reserved.
Browse Resources
Search Help
Upload Content
You searched on:
Learning Area: Mathematics; SOSE; English; LOTE; Science
Publish
Unpublish
Delete
Select
Search Results
Alien life form (Not published) The Learning Federation approved
Help the alien Zorpac to find out about plant life on Earth. Choose different combinations of leaves, seeds and roots to design a plant that is best adapted to surviving in a particular environment. Optimise the plant design to suit survival in specific environments: mangroves; cool rainforest; mountain slopes; arid land. Check results; get feedback on matching the plant features to suit the environment.
Learning Area: Science Strand: Science > Biological science Topic: Plants; Roots (Plants); Leaves; Seeds; Stems (Plants); Adaptation (Biology); Estuaries; Mountains; Deserts; Biodiversity; Reproduction; Habitats; Ecology; Rain; Experiments User Level: 3; 4 Version: 2.0 Size: 1.01Mb
View Summary Details Download
Caving (Not published) The Learning Federation approved
Help Frog to explore a limestone cave. Identify glow worms, bats and rock features such as stalactites. Take photos, then match up pictures with their labels.
Learning Area: Science Strand: Science > Biological science; Earth and space Topic: Animals; Ecology; Land forms; Rocks; Geology; Groundwater User Level: 0; 1; 2 Version: 2.0 Size: 285Kb
View Summary Details Download

Select the items and click publish

Summary

It is not clear from this trial whether it is better for a System to have a centralised or distributed model. It may be more appropriate to have both with those schools on higher bandwidth links using the central BELTS repository and those at more remote locations having a local server.

Issues for a centralised BELTS Server

For

- Only one place to have to get the objects loaded into
- Only one server needed to manage all aspects.
- Lessons easily shared with other users on the network
- PD can be delivered off the central box

Against

- Need management practices to handle naming for lessons and users
- Potential for server performance degradation under load – 40 schools?
- If the server goes down then all schools out
- Objects need to be cached at the local school level

Issues for distributed BELTS Servers

For

- Lessons and objects available on the Local Network
- Lesson naming only critical on LAN
- Caching not as critical as the Server is deploying the objects locally
- If the server goes down then only the local school is out
- The Linux server can handle multiple functions including BELTS (cache, firewall)

Against

- Need management practices to handle distribution of objects
- Need many servers and related management of dependent systems
- Upgrades need to be applied to each server

Lesson management is an issue. Ideally an individual lesson should be able to be exported (without the object) and re-imported as a single lesson on another box. Teachers may wish to clone a part of a lesson and add other pieces to it. This is only possible by completely recreating the lesson pieces that are wanted.

Remote areas, like the Northern Territory, would benefit from a standalone BELTS system with simple object and lesson imports from a CD or floppy.

The details relating to a learning object need to be more detailed. A list of the files used (.swf , .dcr, etc..) the required plug-ins and caching considerations need to be available.

All in all the BELTS system is a very effective mechanism for the deployment of Learning Objects. However it must be noted that Linux expertise is needed to setup and configure the servers to operate especially across a WAN.

Michael Haigh

3 Nov. 03

10 APPENDIX TWO:

Report on The Le@rning Federation trial (Melbourne)

Ms Angela Forgan, Ms Ann Thornton and Mr Paul Barry: Melbourne Archdiocese

The Le@rning Federation Trial Report

Melbourne Archdiocese

By Angela Forgan & Ann Thornton

BELTS Server Testing Report by Paul Barry

CONTENTS

AIMS **62**

PROCEDURES UNDERTAKEN **62**

Trial Schools 62
Trial Objects 62
Data Collection 63
myinternet portal 63
Software 63
Training 63
Caching 64

RESULTS **64**

Performance Measures 64
Bandwidth 64
Myinternet 65
Training 65
Caching 65
Maintenance Measures 65
Software 65
Future upgrades 66
Other Learning Objects 66
Server Load 66

CONCLUSIONS **66**

Software 66
Caching 66
Future upgrades 67
Server Load 67
Download costs 67

BELTS SERVER TESTING **70**

Aims

The trial, conducted by the Catholic Education Office Melbourne (CEOM) was to understand the technical configurations needed on a school network, for staff and students to download and view learning objects from The Le@rning Federation (TLF) server in a reasonable time frame.

Two delivery methods were trialled by the CEOM. The **central** distribution model for the Belts server was one method. This method is where the learning objects are downloaded from the Exchange and stored on the Belts server at CEOM. Other Catholic dioceses around Australia accessed the learning objects from this server. Teachers and/or students were also able to login to the server and view the learning objects in their school as needed.

The second method was using an alternative ASP or third party provider. As myinternet was already an ASP for a number of Catholic dioceses across Australia, including the four Catholic dioceses in Victoria, it was determined that the myinternet delivery provided a sensible alternative to Belts.

Schools chosen had a variety of types and sizes of bandwidth into the school, and participating teachers had some knowledge of learning objects and/or using technology.

Procedures undertaken

Trial Schools

The delivery of the learning objects in the trial was tested initially in five schools – three primary and two secondary using both delivery portals – the TLF Belts server and the myinternet learning management system. After several of the early visits, we suspected the size of the bandwidth had a direct effect on the speed of delivery, and consequently included two additional schools with low bandwidths.

While minimum technical specifications had been outlined by the TLF for software, it was evident from our school visits that there was a variety of computer speeds, configurations and standard software applications across schools. It is important to keep this in mind, as schools have very limited funds to acquire additional hardware and/or software to meet the TLF minimum specifications.

- **St Mary's, Werribee South -** a very small, semi-rural school near Port Philip bay.
- **St Marks, Dingley -** opened in 1974 in a southern residential suburb.
- **St Monica's, Footscray -** old established school with a diverse multicultural community.
- **St Pius X, Heidelberg West -** small school in the north-east of Melbourne.
- **St Vincent de Paul, Strathmore -** only 12km north of the city.
- **Avila College, Mt Waverley -** girls secondary college in the eastern suburbs.
- **St Paul's College, Altona North -** boys secondary college along the western side of the bay.

Trial Objects

In each school, the same learning object 'Indigestion' was viewed so that a direct time comparison could be achieved between the two delivery methods. Indigestion is approximately 760K, a small size compared to some of the later developed objects. It was thought that by restricting the testing size, this would optimise the bandwidth required. This object was also chosen as one that would engage students' attention even if there was a time delay in its arrival on the computer screen.

Data Collection

Data from the trial schools was intended to be collected via two questionnaires – from the teacher using the Teacher Questionnaire (Appendix 2B), as well as technical information using the Technical Questionnaire (Appendix 2C). In addition, observations during visits to each school where the objects were viewed by teachers and/or students.

After the first visit to a primary school, we found it was easier to combine the surveys and complete them ourselves as the teachers were busy in the classroom assisting students. Generally, the classroom teachers were unfamiliar with the technical specifications, so we undertook the checking of each computer used in the trial, by watching and recording the download time.

While we only gave students directions on how to access the learning objects, It was quickly evident that once the students viewed it (Indigestion), they were totally engaged, and replayed the object several times over. After finishing that one, they were keen to be involved in trialling more for us! This occurred in both the primary and secondary classes.

The majority of primary classrooms we visited had 3-5 computers per room, so we trialled the learning objects on whatever number of computers the software installed, were able to run the objects. Sometimes this may have been 5 computers simultaneously, sometimes it eventuated that only one or two computers were powerful enough to view the objects. With the secondary classes, we were viewing them in a computer laboratory with around 25 computers accessing the object at any one time. Again, we tried to conduct the trial under 'realistic' conditions of how these teachers would use the objects in the future.

myinternet portal

All Victorian Catholic primary schools use the myinternet portal. As such, it was seen by the CEOM as an important part of the trial to ensure that the learning objects were able to be accessed and viewed via this application.

Software

Understandably, the role of plugs-in was critical in the successful viewing of any learning object. While it was apparent moving around primary schools that in MacIntosh environments this software was part of the standard suite of software installed, but this was not the case for PCs. These software applications are not seen as standard **in primary schools** and needed to be installed on the machines prior to testing, even if they are freely available on the Internet.

In each case, the primary schools visited had requested their technician to install at least Shockwave and Flash Player before our visit occurred. We endeavoured to make as few changes as possible to the schools' networks, so that it was a realistic sample of schools. However, if we could not readily check the configuration of a particular computer, we did not include it in the sample.

Training

Two teachers from both secondary schools attended a half-day training session at the CEOM so that teachers had the opportunity to understand the concept of a 'learning object', and create an online lesson in Belts with the learning object included. This object then formed the basis of their trial. Back at their school, teachers were able to login to the server to add additional lessons, or enable their students to login with a lesson ID to interact with the lesson created and view the learning object included.

Because all Catholic primary schools in Victoria have used the myinternet portal for the last 5 years and the schools chosen were familiar with learning objects and creating lessons with them, no training was needed for these teachers. We gave them a login to the Belts server, and they viewed the object after searching the Resources.

Caching

Another important consideration to include in the trial was how effectively learning objects could be cached, especially when it was noticed that some objects were up to nearly 4MB in size.

Caching will not only impact on the download time, but also on the cost to schools. If objects can be cached on the school network, then the download time, should be considerably quicker except for the first user of the object. Schools using ISPs will only be paying for the first download of the object, not for subsequent use.

It was very evident when trialling learning objects in both secondary and primary classrooms that students were engaged when using the learning objects. Once the object was completed, they immediately played it again, and again, as many as four or five times to see what all the potential outcomes were. Even where the object took 30 seconds or more to download, this was not a deterrent.

It became vital to know even if a caching device could not cache the objects, that the testing should investigate when an object was viewed several times over, whether caching occurred in the browser of the computer used.

If a school had to pay download costs for every single download of a learning object, x the number of students in a class, x the number of times it was viewed by each student, then the cost would be significant, and this would then have to be multiplied by the number of classes doing this in the school. Over a period of a year, this would mean a huge increase in download costs.

Results

Our findings on the use of the Belts regional model and the myinternet portal to view learning objects are based on the following survey indicators.

- Performance Measures
- Maintenance Measures

Performance Measures

Bandwidth

All Victorian Catholic primary schools were upgraded with a minimum standard bandwidth of 64-256K ADSL in May 2003. (*ADSL - asymmetric digital subscriber line - permits a large part of the bandwidth to be used for download to the user (eg up to 1.5MB bps) and uses only a small part to send upload requests from the user (up to 256K bps*). Several schools were unable to receive data via ADSL, while some other schools chose to have a higher level of bandwidth. All of these variables were included in the trial, so that an idea of the role and size of bandwidth could be seen.

• St Mary's, Werribee South	64K	ISDN
• St Marks, Dingley	128K	ISDN
• St Monica's, Footscray	64K-256K	ADSL
• St Pius X, Heidelberg West	64K-256K	ADSL
• St Vincent de Paul, Strathmore	256-1.5 MB	ADSL
• St Paul's College, Altona North	1024	DAR
• Avila College, Mt Waverley	256-1.5 MB	ADSL

Details of the exact specifications of each computer tested in each of the seven schools is outlined in Appendix 2D.

The schools with the higher level bandwidth (256-1.5MB ADSL) experienced virtually instant delivery of the learning objects almost regardless of the power of the computer being used. Even where slower computers, eg, Celeron with 64 MB Ram, were used, students were still able to view the objects immediately and within the 10 second timeline required.

It became clear from visiting the schools with the "standard" bandwidth, that the downloading of the learning objects took considerably longer than for those with the higher level bandwidth even with a similar computer configuration. While 30 seconds seemed a long time, students were content to wait for the object to appear, once they knew it would eventually arrive on the desktop. It was evident that once students had seen the object 'Indigestion' they were quite untroubled by the time delay, as they wanted to continue reloading and interacting with it.

Where the school was unable to install an ADSL connection and had ISDN instead, even with Pentium 4s, the download time was at least 60 seconds, and became impossible with slightly less powerful machines. Further analysis is required in schools with "low-level" bandwidth connections to ensure that delivery in a reasonable time frame is possible.

myinternet

At each school visited (except Avila College) and on all computers tested, the identical learning object 'Indigestion' was selected, using both the Belts server and the myinternet portal as the delivery mechanism. In every case, there was no time difference noted between the two delivery methods, therefore, it would seem that viewability nor download time is affected by the delivery mechanism.

Training

Understandably, students in all schools except Avila, were more comfortable using the myinternet portal, than they were using Belts, as this system has been used in Catholic schools since 1999. Since there appeared to be no difference between the two methods in terms of download time, it would seem logical for these schools to continue using myinternet for the future delivery of learning objects.

This naturally minimises the professional development training of staff and the associated costs likely to be incurred, when the objects are available for release to schools.

While a half-day training session was conducted for the teachers from Avila and St Paul's using the Belts server, longer training may be required for teachers who have a lower level of ICT competency.

Caching

Using a sophisticated caching device called a CacheFlow, our testing on site at the CEOM concluded that caching, does not happen with all learning objects. Paul Barry's report '*BELTS server tesing*' (which follows) indicates that from the check of the log files over the test period, that a percentage of the flash files are actually cached.

Internet Explorer was used as the browser software in all schools and at the CEOM. As can be seen by the report from Paul, Internet Explorer did cache the learning objects for a particular session. Once a student downloaded the learning object, it was cached while that student replayed it over and over. However, once the browser was closed at the end of the session, caching no longer occurred. This means that download costs are incurred the first time in a class that each student downloads an object, but not if they keeping replaying the *same* object. Of course, if a new object is downloaded this will incur further cost.

Maintenance Measures

Software

For primary schools, this may create an additional cost if they are to view learning objects, as it could take a technician several hours to download the software to the network and subsequently install it on every machine in the school. However, at both secondary schools, all the required software was already installed across the network, probably due to the nature

of the type and range of software used across the curriculum in a secondary setting. It is anticipated that this would be the case for all secondary schools.

Future upgrades

If a central model were to be used, a high-level technician would be required to set up the central Belts server at the central location. The tasks undertaken by the technician at the set up stage of this trial included: setting up an IP address, adding extra fields to the sml file due to the security access required when using the myinternet portal, and changing the port number. These steps took approximately an hour using the instructions provided by TLF.

As a result of the release of the upgrade 1.1.1, the CEOM upgraded the Belts server. One of our technicians had a working knowledge of Linux, while our high level technician was unfamiliar with Linux. After spending several days trying to follow the documentation provided on the TLF web site we found we had to rely on the TLF to upgrade the server and to troubleshoot technical problems.

Even for a Linux technician, reading the instructions for the first time, for upgrading of the server, it was not a straightforward process. For those without Linux technical knowledge, it could seem a complicated procedure. Having worked as a Network Administrator in a secondary school, I can confidently say, that this is not a task that could be undertaken easily by many school administrators.

Once the upgrade occurred, it was then necessary to download all the objects from the Exchange again. However, there were technical problems encountered with this process as well, which the TLF investigated and then rectified.

In comparison, using myinternet means that they provide the expertise and undertake the related work involved in setting up the myinternet servers for delivery of the learning objects or downloading the objects from the Exchange.

Other Learning Objects

The myinternet portal is designed in such a way, that it provides access to other learning objects from around the world, not just those supplied by the TLF. However, the Belts server does not appear to provide a mechanism to access these other objects.

Server Load

The report by Paul also includes data on gauging the load when a central model is used for delivery, and indicated that the delivery time at a single school increased from 10 seconds to 28 seconds when a simulation of 10 schools downloaded objects, on a bandwidth of 256Kbps.

Conclusions

Software

As the software is such a crucial part of the successful delivery of objects to schools, successful installation of the software is important. To support schools and sectors undertaking their own installations I understand the Canberra-Goulburn diocese has developed a wizard which tests the computer and assists in the installation of the required software.

The further development of this wizard would be a worthwhile step in assisting teachers in schools to work with objects and to reduce the costs of employing technicians to install essential software.

Caching

Most schools would use a simpler and cheaper caching device – (eg Microbits Pizza Cache, Microsoft Proxy or Novell Border Manage), than the CacheFlow used by the CEOM. Nevertheless, it is important to determine whether these devices are able to cache this type of content.

It is essential that the caching issue be carefully and clearly determined. Schools using ISPs could experience a significant increase in download costs when classes view objects of several megabytes, over a number of lessons in a week, if caching at the school site is not possible.

Future upgrades

If technical support is needed for each subsequent upgrade, then the central model for distribution to schools could be a preferred model. This approach would mean that the services and associated costs of a Linux technician would be required centrally by education offices within each diocese to manage and administer a Belts server for delivery of objects to their schools, or myinternet can continue to be used.

Consideration could be given to further work being undertaken to support simplifying and automating the software upgrade process and associated documentation for those not using myinternet; and to the training of administrators in upgrading the software.

Server Load

CEOM have found that further investigation is required if more than 10 schools outside the myinternet arrangements are using a central server at any one time. Further investigation of the hardware and software configuration of the Belts server to determine if initial response times can be improved from the average of 28 seconds that was recorded during these tests, could provide some useful intelligence.

Download costs

The other critical difference between using the myinternet portal and the Belts server is in relation to download costs. As myinternet is housed at the server farm inside our virtual private network, myinternet schools do not pay any additional costs to download the learning objects, regardless of the number of times they use the TLF learning objects. However, for any non-myinternet schools, they will be paying download costs to their ISP based on the frequency of use of the learning objects.

There are directions needed for schools if they are to make the most of the TLF learning objects. These are:

1 Advice to schools on the computer configurations required for each type of bandwidth

2 Advice about the need for the plug-ins to be installed across the network

3 Advice about the likely impact on download costs and how these can be minimised when using learning objects

To further improve the delivery of learning objects to schools, the following is proposed:

1 Further research into the caching of learning objects so that advice can be provided to schools in order to minimise download costs

2 Jurisdictions will have to decided whether a central model or a distributed model will be used for the delivery of learning objects

3 Further research is undertaken to simplify the BELTS upgrade processes

4 Technical training is developed and made available to jurisdictions on BELTS server management

5 Further research on server loads is undertaken to ensure that a reasonable response times are experienced at the school site.

Belts Server Testing

By Paul Barry

Objective 1: Evidence that it is not possible to cache learning objects using Cacheflow

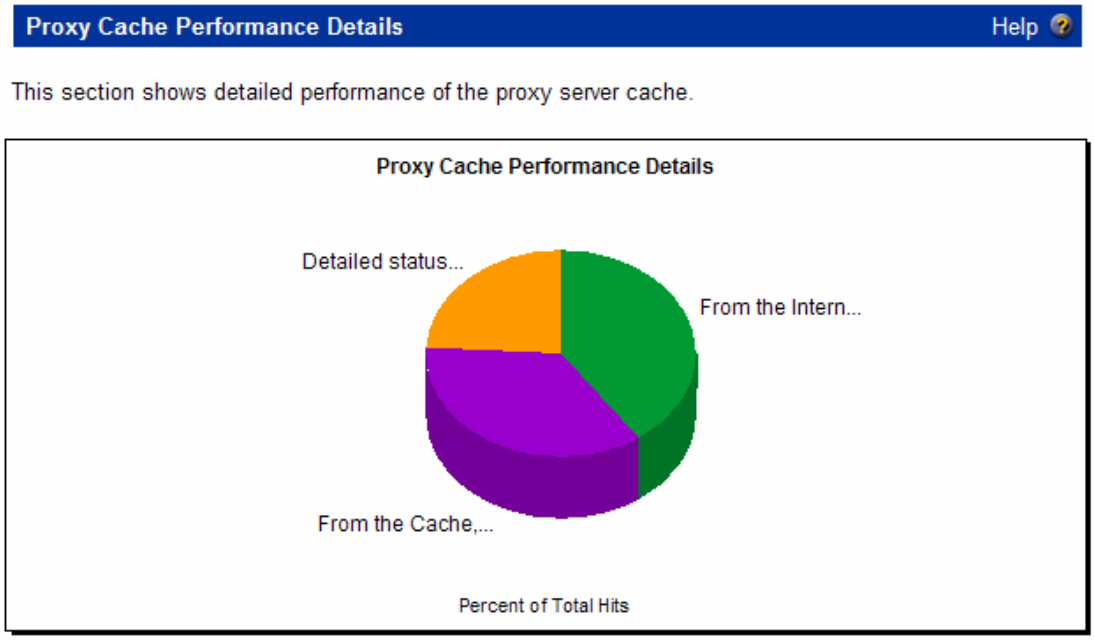
Test Equipment:

- 1 Cacheflow Client Accelerator 611 Device;
- 1 Belts web server;
- 1 Desktop workstation used to manage the Cacheflow 611; and
- 1 Laptop computer used to browse to and navigate the test site: http://belts.ceo.melb.catholic.edu.au/

Test Scenario:

1. 5 learning objects were randomly selected and played through.
2. The Cacheflow log files were cleared.
3. The same 5 learning objects were again selected and played again.
4. The Cacheflow log files were gathered and examined to determine how much of the content was returned from cache.

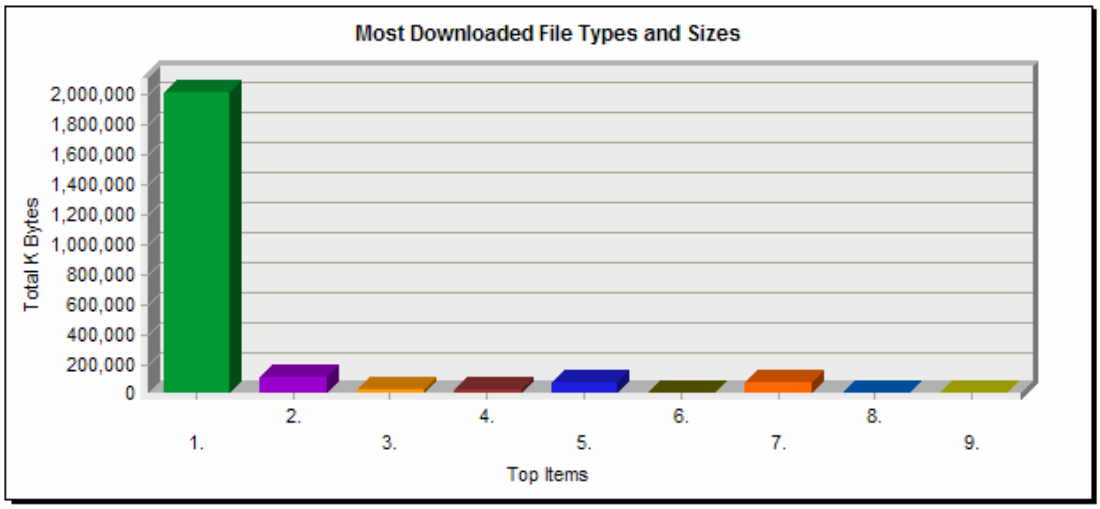
Results:



Proxy Cache Performance Summary			
Status	Hits	% of Total	Bytes
From the Internet	78	40.20%	1.80 M
From the Cache	69	35.56%	235.76 K
Unknown	47	24.22%	264.33 K
Total	**194**	**100.00%**	**2.29 M**

Most Downloaded File Types and Sizes Help

This section identifies the download file types and the total kilobytes downloaded for each file type.



Most Downloaded File Types and Sizes			
	File type	No. of Files	Bytes
1	*.swf	62	1.91 M
2	*.gif	22	103.70 K
3	*.css	12	28.41 K
4	*.jpg	9	31.64 K
5	*.html	9	74.11 K
6	*.js	7	6.38 K
7	*.xml	5	78.01 K
8	*.htm	4	4.76 K
9	*.png	1	1.66 K
10	*.html;jsessionid=47mhpm4w5jxs	1	4.22 K
Subtotal for File Types Above		**132**	**2.24 M**

Interpret Results:

The results from this test indicate that 35 % of the content contained on the belts web server can be cached when viewing learning objects.

Closer analysis of the log files shows that the majority of flash learning objects were not cached, as can be seen below by the; **TCP_NC_MISS/200** tag.

90 10.160.9.10 **TCP_NC_MISS/200** 746 GET http://belts.ceo.melb.catholic.edu.au/content/exchange/204/2.0/Content/LV1013/sc_01_qantm_20/js/script.js - DEFAULT_PARENT/proxy.ceo.melb.catholic.edu.au application/x-javascript.

Interestingly a small number of the flash learning objects have been tagged with a TCP_HIT/304 indicating that they were served from cache as seen below;

10.160.9.10 **TCP_HIT/304** 29 GET http://belts.ceo.melb.catholic.edu.au/content/exchange/46/2.0/Content/LV489/LO_03/20030228/LO_03.swf - DIRECT/- -

This would account for the fact that some of the flash learning objects would need to be returned from cache as 85.26 per cent of the files downloaded were swf files (x-shockwave-flash) and would need to be accounted in the 35 % of the cached content.

Conclusion:

This investigation has proven that approximately 35 % of the content on the belts web server can be cached which will save non CEVN-IS schools some of the download costs associated with using this resource site and improve end user performance at all schools.

Recommendations:

It is recommended that the developers of the site are asked to investigate why a small percentage of the flash objects returned from this site were cached as opposed to the majority of sites that were not. PB has sent this question to some contacts he has in this field and will supply any responses gathered to Angela Forgan.

Objectives 2 & 3:

- Virtual testing of the Server Impact if 40 (non-myinternet) schools are all downloading learning objects
- Estimated impact on our bandwidth if 40 schools are downloading objects

Test Equipment:

- Web Performance trainer software (Demo version 10 user limit);
- 1 Belts web server;
- 1 Desktop workstation used run Web Performance trainer software and browse to and navigate the test site: http://belts.ceo.melb.catholic.edu.au/

Test Caveats:

The testing software could not be configured to work with the proxy authentication at SINA. The testing was therefore done connecting to the Belts server directly on the CEO Head Office LAN. The simulated bandwidth was kept at 256 Kbps to simulate a typical primary school connection.

The testing software was run in Demo mode so the maximum number of simulated users was limited to 10 (ten).

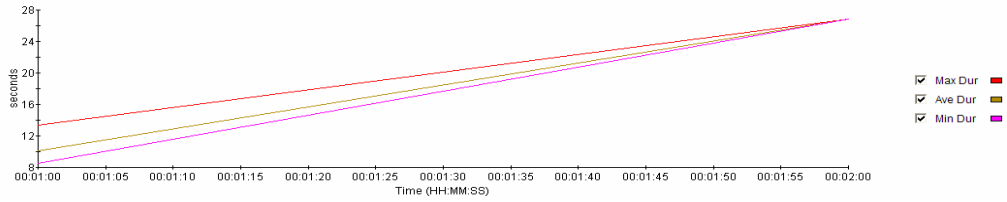
User vs. Time Test:

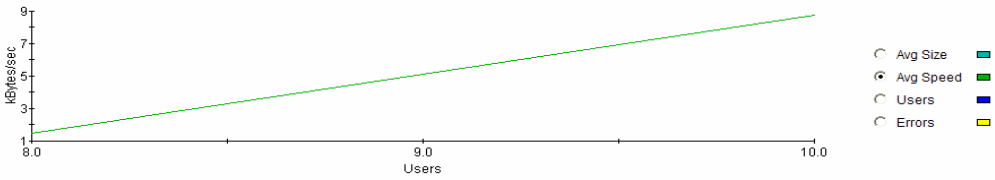
Test Object:

Compound Shapes: Small Shapes

http://belts.ceo.melb.catholic.edu.au/resource/exchange/150/1.0/view.html

Results:

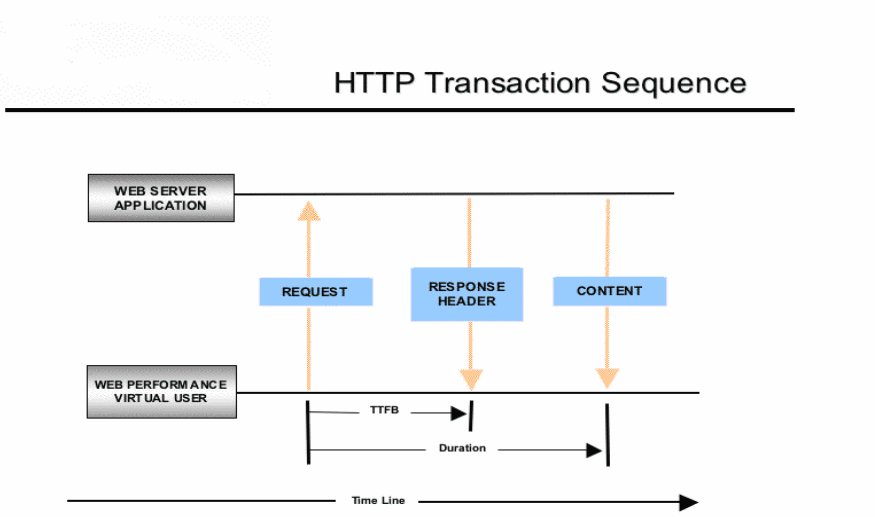




Above there are 2 graphs containing detailed information about the specified object during the test run.

The default charts show the maximum duration and number of users plotted against time. This provides an instant picture of how the maximum duration is impacted by the number of users.

Transaction Sequence Test:



Test Object:

Compound Shapes: Small Shapes

http://belts.ceo.melb.catholic.edu.au/resource/exchange/150/1.0/view.html

Results:

Time	Repeats	Min TTFB	Avg TTFB	Max TTFB	Min Dur	Avg Dur	Max Dur	Avg b/s	Bytes	Users	Errors
3:00	3	00:26:89	00:28:83	00:30:77	00:27:05	00:29:00	00:30:95	123	7140	10	0

Note that the format for the recorded performance statistics durations is MM: SS.HS, where MM is minutes, SS is in seconds, and HS is in hundredths of a second.

Time	This column contains the time the values in the row were sampled.
Repeats	The cumulative number of times the business case, web pages, or URLs were repeated. Each virtual user is assigned a business case to execute over and over again, and this number tells how many times each business case, web page, and URL was repeated.
Min TTFB	The minimum time to first byte during the time period.
Avg TTFB	The average time to first byte, or the time it took for the web server to first respond to the HTTP requests.
Max TTFB	The longest time the web server took to respond to the HTTP request during the time period.

Min Dur	The minimum time it took for the virtual user to receive all of the business case, web page, or URL back from the web server. This is the fastest a user would have viewed the results.
Avg Dur	The average duration it took for the virtual user to receive all of the business case, web page, or URL back from the web server.
Max Dur	The maximum time it took for the virtual user to receive all of the business case, web page, or URL back from the web server. This is the slowest a user would have viewed the results.
Avg b/s	The average data rate (bytes/sec) achieved by each virtual user.
Bytes	The total data transferred between Web Performance TrainerTM and the server during the sample period.
Users	The total number of virtual users running at the end of the sample period.
Errors	The number of errors that were generated during the sample period by either the selected business case, web page, or URL.

User Capacity Test:

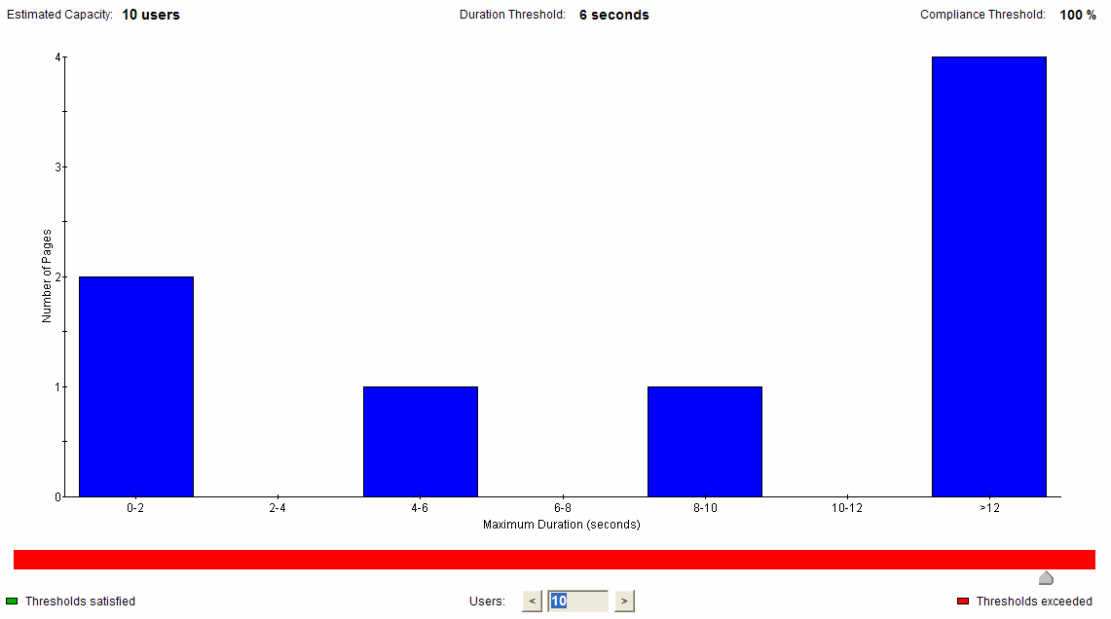
The User Capacity report determines the capacity of your web site based on the selected test results and configurable performance thresholds.

Test Object:

Test case involving the downloading and playing of the learning object from the home page of the Belts server;

Alien Life Form and the associated pages

http://belts.ceo.melb.catholic.edu.au/resource/exchange/29/2.0/view.html



"Number of Pages vs. Duration" bar chart

The bar chart illustrates the performance of the business case by displaying the number of web pages in each time range, when the test was running with a certain number of users. In the above example, the blue bar on the left indicates that 2 pages in the business case had a maximum duration in the 0-2 second range when 10 users were running the business case.

Interpret Results:

The User vs. Time Test indicates that the duration of the object loading time rose from approx 10 seconds to 28 seconds as the user load increased from 1 to 10 in a 2 minute period.

The Transaction Sequence Test results from this test indicate the server begins serving content back to the end user in an average of 28 seconds when 10 users are accessing the site with a bandwidth of 256 Kbps. The average duration was only 2 seconds longer measured at 30 seconds indicating that the bottleneck seems to be at the server responding to the initial request. Once the packet transfer began occurring, the transaction time was relatively short

The User Capacity Test results show that the majority of pages will be served over a 12 second threshold seconds when 10 users are accessing the site with a bandwidth of 256 Kbps.

Conclusion:

This investigation highlights the fact that the server's response is impacted by a user load of ten and this needs to be factored to a scale of 40 to answer the objective of this investigation. The testing also highlights the fact that the performance of the server; especially in regard to the time taken to respond to the initial response should be examined with the objective of improving the response time.

Recommendations:

It is recommended that the developers of the site are asked to investigate the hardware and software configuration of the belts server to determine if the initial response time to requests when under a user load of ten can be improved from the average of 28 seconds that was recorded during these tests.

Objective 4: Impact on bandwidth if other dioceses (eg Sale) were to host a regional server with ADSL.

Whilst no specific testing was done for this objective; it is estimated that in Victoria, the only Diocese office that could not effectively host a regional belts server would be the Sale office.

Ballarat Office utilises a 512 Kbps symmetrical LMDS link and the Bendigo diocese office utilises a 1.5/256 Kbps asymmetrical ADSL link. Both of these services are estimated to effective serve a Belts web server to their regions and take bandwidth load away from the CEO Head office.

The Sale diocese office utilises a 256/64 Kbps asymmetrical ADSL link which is not estimated to effective serve a Belts web server to the region. The lower data rate of 64Kbps outbound would severely limit the rate of data served especially under user load.

10.1 APPENDIX TWO A

Technical requirements

The following specifications were identified by the Melbourne Archdiocese and provided to the schools participating in the trial.

Technical Requirements

In order to trial the Belts delivery in your school, the PCs to be used need to meet a basic hardware configuration. Please contact Angela Forgan at the CEO on 9267 0425 if you have any questions or problems about these requirements.

If you have more than one type of operating system or configuration available in your school, it would be most appreciated if more than one could be used for the trial of the learning objects.

Operating System

Windows	*Macintosh*
98, NT, 2000 or XP	Mac OS X v10.1.5+

Processor

Pentium II or higher	Power PC G3 or higher

Memory

64 MB RAM minimum	128 MB RAM

Browsers

Internet Explorer Version 6.0

Netscape Navigator Version 7

Plug Ins Required

Adobe Acrobat Reader Version 5

Adobe SVG Viewer

Macromedia Flash Player Version 6

Macromedia Shockwave Player Version 8.5

Java for Windows

QuickTime Player Version 5

10.2 APPENDIX TWO B

Teacher questionaire

The following questionaire was distributed by the Melbourne Archdiocese to the schools participating in the trial.

BELTS – Teacher Questionnaire

In order to conduct an effective comparison between users and schools accessing the BELTS server at the CEO Melbourne, we need to gather information about factors that may affect the accessibility of Belts.

These factors will then enable us to make assessments about basic requirements schools will need when accessing learning objects from the Belts server.

1 Before your school could begin using learning objects on the Belts server, what steps did you take to set up the Belts lessons for your classes and students?

_____

2 How long did this take?

_____

3 Would you be prepared to do this for each class or lesson you wanted to use the Learning Objects for?

_____

4 What was the time of the day? _____

5 How long did it take to set up the lesson? _____

6 What problems did you encounter (if any)?

_____

7 What documentation did you use? _____

8 How helpful did you find it? _____

_____

9 How many seconds did it take to see the learning object appear on screen for the first user?

10 Is this an acceptable time to wait ?

_____

11 How many seconds did it take for the **SAME** learning object appear on screen for the next group of users?

_____

12 Is this a **MORE** acceptable time to wait ?

_____

13 If this means that you, as the teacher, has to view the learning objects sometime prior to using them in class, is this reasonable in order to use them effectively as learning tools?

_____

14 Was there anything else that you required/needed in order to use the learning object?

_____

10.3 APPENDIX TWO C:

Technical Questionnaire

The following technical questionaire was distributed by the Melbourne Archdiocese to the schools participating in the trial.

BELTS - Technical Questionnaire

In order to conduct an effective comparison between users and schools accessing the BELTS server at the CEO Melbourne, we need to know some basic data about your school's LAN and the configuration of computers used in the trial.

These factors will then enable us to make assessments about basic technical requirements schools will need when accessing learning objects from the Belts server.

1 Before your school could begin trialing the learning objects on the Belts server, what steps did you have to take to set up the computers?

_____

2 How long did this take?

_____

3 What was the configuration of the PCs used? (speed, RAM, virtual memory) Complete the table over the page.

_____

4 What other software did you need installed to view the learning objects? (Flash, etc)

_____

5 What time or support/ help did you need for this?

_____

6 What is the speed of your LAN?

_____

7 What type of bandwidth connects the school to the internet? (ISDN, ADSL, etc)

_____

8 What is the bandwidth speed of your internet connection?

_____

9 What type of Proxy Server/Caching device is in the school? (if any)

_____

10 Which Learning Objects were downloaded?

_____

11 What was the time of the day?

_____

12 How long did it take?

_____

13 How many other users were accessing the Internet at the same time? (approx)

_____

14 Was this on the Curriculum or Admin side of the network? (if applicable)

_____

15 Was the documentation you received helpful? Explain.

_____

16 Was the level of technical support sufficient? Explain

_____

17 What other issues or problems did you encounter?

_____

10.4 APPENDIX TWO D:

Computer and bandwidth configurations used in the Melbourne trial.

Configuration of PCs used in Belts Trial

PRIMARY	*Bandwidth*	*Computer Specs*	*RAM*	*Browser*	*Loading Time*
St Mary's, Werribee	64K ISDN				
computer 1		Pentium 3 Win 98	256MB	IE v 5.2	~2 mins
computer 2		Pentium I Win 98	64MB	IE v 5.2	Did not load
St Mark's, Dingley	128K ISDN				
computer 1		Celeron 333Mhz Win 98	64MB	IE v 6.0	2 min 15 secs
computer 2		Celeron 500Mhz Win 98	128MB	IE v 6.0	58 secs
computer 3		Celeron 1.3Ghz Win 98	128MB	IE v 6.0	52 secs
computer 4		Pentium III 800 Mhz Win 98	128MB	IE v 6.0	52 secs
computer 5		Pentium IV 2 Ghz Win 98	256 MB	IE v 6.0	48 secs
St Monica's, Footscray	64k-256K ADSL				
computer 1		Celeron 500 Win 98	192MB	IE v 6.0	~30 secs
computer 2		Celeron 500 Win 98	192MB	IE v 6.0	~30 secs
computer 3		Mac OSX 9.2.2	128MB	IE v 5.1	~30 secs
computer 4		Mac OSX 9.2.2	128MB	IE v 5.1	~30 secs
computer 5		Mac 233Mhz OSX 9.0.4	96MB	IE v 5.2	* after several LO loaded, then gave an error message saying "Out of Memory"

St Pius X, Heidelberg	64k-256K ADSL				
computer 1		ibook 500Mhz (laptop) Power G3 OSX v10	128MB	IE v 5.2	~4 secs
computer 2		imac 700Mhz Power G3 OSX v10	128MB	IE v 5.2	~4 secs
St Vincent de Paul, Strathmore	256k-1.5MB ADSL				
computer 1		Pentium 4 Win XP	128 MB	IE v 6.0	~4 secs
computer 2		Celeron Win 98 2nd edition	128 MB	IE v 6.0	Did not load
computer 3		Travelmate Laptop Win 98 2nd edit	128 MB	IE v 6.0	Did not load
computer 4		Power PC G4 OSX	256 MB	IE v 6.0	~4 secs
computer 5		Pentium 2 Win 98 2nd edit	64 MB	IE v 6.0	Did not load
computer 6		700Mhz Laptop Win 98 2nd edit	128 MB	IE v 6.0	25secs

SECONDARY					
Avila College, Mt Waverley	256k-1.5MB ADSL				
computer 1		Celeron 400 Win 95	64MB	IE v 5.5	~4 secs
computer 2		Pentium Win XP	512MB	IE v 6	~4 secs
computer lab (25 computers)		Celeron 400 Win ME	64MB	IE v 5.5	25 secs
St Paul's College, Altona	1024K DAR				
computer 1		Celeron (Pentium 100) Win ME	60MB	IE v 5.5	10 secs
computer 2		Celeron Win ME	48MB	IE v 5.5	10 secs
computer lab (25 computers)		Celeron Win ME	48MB	IE v 5.5	
*Indigestion was the LO loaded at each school					
Belts server was used to view LO in each school					
myclasses portal was used to view LO in each school					
No time differences noticed between Belts or myinternet					

11 APPENDIX THREE:

Accessing learning objects in remote Catholic schools in the Northern Territory: Report of CD trial.

ACCESSING LEARNING OBJECTS IN REMOTE CATHOLIC SCHOOLS IN THE NORTHERN TERRITORY

REPORT OF CD TRIAL

Purpose

The purpose of this part of the project was to gather data to assist The Le@rning Federation to evaluate distributed delivery of learning objects through the use of CD ROMs.

Model of delivery

CD ROMs

Background

There are schools located in remote regions of Australia for whom reliable access to the Internet remains illusive.

The Le@rning Federation is committed to facilitating access to learning objects by all students, irrespective of their physical location. While access to the Internet is not universal for all students, the provision of learning objects on CD ROMs may provide an interim arrangement for these students.

Context of the trials

Four remote schools in the Diocese of Darwin in the Northern Territory were selected by the Coordinator of Curriculum and Indigenous Education in the Catholic Education Office in the Northern Territory to participate in this part of the project. Five teachers from these four schools participated in the trial.

Description of the schools

All schools are identified as 'remote'47.

One was a Primary school, one was a Secondary school, and two were primary/secondary on one campus. Secondary schools in this context generally cater for students up to 15 years of age, with some VET program for a few older students.

Description of the IT facilities

Catholic schools in the Northern Territory have access to the LATIS server. These computers do not have CD ROM drives provided in the hardware. Instead CD ROM towers are used.

The CD ROMs were trialed by four teachers in three schools on stand alone PCs; and at one school the CD ROM was trialled on both the LATIS server and on a stand alone PC.

The following computers were used to trial the learning objects from the CD ROM.

[47] 'Remote' schools in the NT are those schools located in small Indigenous communities with variable access to major centres such as Darwin and Alice Springs; (eg between one and five hours travel by unsealed road variable with seasons, limited to small plane travel) The schools in this study range from those with a student population of between 60 and 250.

Ltyentye Apurte

	Operating system	Processor	RAM	Browser & version
Computer 1 (LATIS)	Windows Professional 2000	Pentium II	63 OMB	Internet Explorer
Computer 2 (IDL)	Windows Professional 2000	Intel (R) Pentium (R) 4CPU 2.66GHZ	515, 568 Kb	Internet Explorer Broadcom Net X Treme gigabit ethernet

Our Lady of the Sacred Heart School

	Operating system	Processor	RAM	Browser & version
Computer 1 (Home computer)	Windows 2000	IBM	N/A	N/A

Bathurst Island

Computers in both schools on Bathurst Island use Dell computers.

	Operating system	Processor	RAM	Browser & version
Computer 1	Microsoft Windows XP	Intel Pentium II	128MB	Internet Explorer 6

Method of data collection

Information was collected through the use of two teacher questionnaires and through a teleconference.

Schools were provided with:

- a CDROM with the learning objects and links to the required plugins
- a couple of handwritten instructions to access the learning objects;
- two questionnaires to be completed by teachers trialing the CDs; and
- a summary of the technical requirements for accessing BELTS.

Teachers selected were those with IT responsibility in the school eg the ICT teacher. In one case a classroom support teacher.

Teachers completed the questionnaires and returned them to the Catholic Education Office.

A teleconference with some of the teachers participating in the trial was held.

Description of use of the CD ROMS

Planning[48]

Two teachers indicated that they had planned to use the CD ROMs in their computer classes.

[48] This refers to the planning teachers do in preparation for teaching a class. Here it includes familiarisation with the CD use as well as the content of the learning objects

Implementation

No teachers trialled the use of the CD ROMs in the classroom.

Evaluation

Teachers found the setup of the CD ROM frustrating.

Once those teachers were able to access the learning objects they indicated that the learning objects looked interesting.

Issues arising

- The trial was a frustrating experience for all the teachers involved.
- Two teachers were able to download the learning objects but getting there was frustrating
- Given the set up of the CDROM the degree of technical literacy required of those in each remote location was too high
- The menu structure on the CD ROM was difficult to access
- The plugins launch to the Internet which defeats the purpose of putting the learning objects onto CD.

12 APPENDIX FOUR

National Catholic Education Commission BELTS deployment and distribution chain.

Mr Adrian Brown National, Catholic Education Commission

National Catholic Education Commission BELTS deployment and distribution chain

There are a number of models for the distribution of TLF content to Catholic schools across Australia. In those states where collaborative arrangements with systems have been negotiated, the content will be delivered via the respect system repository. Where existing arrangements with an ASP (for example, myinternet) are in place content will be delivered via this service.

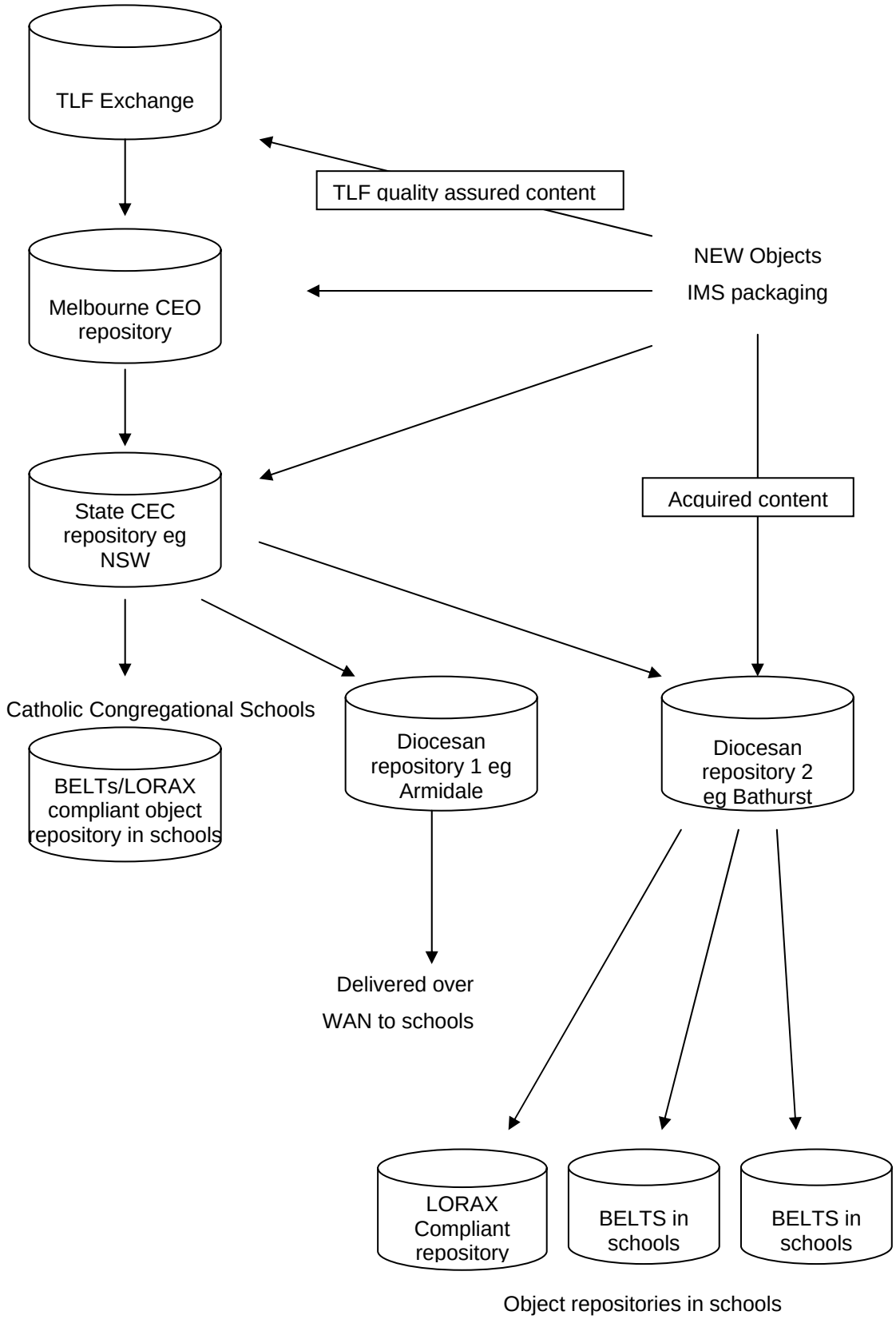
To enable the delivery of TLF learning objects to all other Catholic Schools in Australia a repository has been set up for the National Catholic Education Commission in the Melbourne Catholic Education Office that connects with the TLF Exchange. From here objects are replicated to repositories in each of the State and Territories.

While each Commission will replicate the Catholic repository in Melbourne, delivery of objects to schools will mainly occur from diocesan offices.

At the diocesan level two alternative models for deployment are emerging – each with its own advantages:

1. Where the repository is located at a diocesan level with the objects delivered to schools across a WAN the capacity for sharing of “good practice” lessons is opened up. The protocols for clearly identifying these lessons are in the process of being determined. What has been highlighted so far is the necessity for naming conventions for these lessons so that they are easily discoverable, not only by the use of clearly identified names but also in by succinctly described content (meta-metadata!). Associated with this is the need to provide adequate professional development so that the “good practice” lessons do not become like a series of blackline masters, but rather exemplar lessons which teachers can adapt to their own classrooms through co-creation.
2. Employing a BELTS box in schools which replicates the diocesan repository reduces the sharing “good practice” across schools but is compensated for by much faster access in busy classrooms (providing the problems associated with caching are resolved). Interestingly, however, a different kind of sharing is emerging. Science objects are being shared between Science classes and English classes for example. Furthermore, we are now looking at a hybrid model where clusters of schools share a BELTS box as well as having boxes located at their own premises.

Distribution chain for Catholic schools that do not have collaborative arrangements with systems or a pre-existing arrangement with an ASP



13 APPENDIX FIVE

Description of all schools used in the trial.

Schools	Location	School context
Canberra/Goulburn		
Sacred Heart Central School	Cootamundra	162 primary & 122 secondary students. Medium size rural school located on the southwest slopes in NSW. Origins dating back to the primary school that started in the 1870s. It has had several transformations over the 20th Century.
St Anne's Central School	Temora	176 primary & 65 secondary students A small school on the edge of the Riverina catering for students from K to year 10. The school has its foundations in 1881 with the first building opened in 1900. There have been several additions since then.
McAuley Catholic Central School	Tumut	234 primary & 138 secondary students. Small to medium central school located on the southwest slopes of the Snowy Mountains.
St Mary's War Memorial School	West Wyalong	103 primary & 20 secondary students. Small Rural school located on the central western slopes in NSW. Origins in the late 1800s with the current buildings dating to the early to mid 1900s.

Melbourne		
St Mary's	Werribee South	A very small, semi-rural school with 52 students near Port Philip bay.
St Marks	Dingley	Opened in 1974 in a southern residential suburb. It has 386 students.
St Monica's	Footscray	Old established school with a diverse multicultural community. It has 175 students.
St Pius X	Heidelberg West	Small school with 158 students, in the north-east of Melbourne.
St Vincent de Paul	Strathmore	12km north of the city, with 435 students.
Avila College	Mt Waverley	Girls secondary college in the eastern suburbs with 1053 students.
St Paul's College	Altona North	Boys secondary college along the western side of the bay with 713 students.

Northern Territory		
Ltyentye Apurte	Santa Teresa	Indigenous community school 80kms east of Alice Springs, average student enrolment of 135 students. Co-educational Pre-school to Year 10 equivalent.
Our Lady of the Sacred Heart School	Port Keats (Wadeye)	Large Indigenous community school 250 kms south west of Darwin, average student enrolment of 275 students (potential student enrolment of 600). Co-educational Pre-school to Senior Secondary
Murrupurtiyanuwu	Bathurst Island (Nguiu)	Indigenous community school 80km north of Darwin, average student enrolment of 190 students. Co-educational Pre-school to Year Seven.
Xavier Community Education Centre	Bathurst Island (Nguiu)	Indigenous community school 80km north of Darwin, average student enrolment of 56 students. Co-educational Secondary.

14 APPENDIX SIX

Bandwidth and IT configurations for all schools involved in the trial.

Canberra/Goulburn Archdiocese

Sacred Heart Central School: Cootamundra

Bandwidth: ADSL connection512k/128k

	Operating system	Processor	RAM	Browser & version
20 x	W 98 SE	P 2	128	IE 5.5

St Anne's Central School: Temora

Bandwidth: Until October 18 2003: Satellite Connection - 220k/47k.

From 19 October 2003 ADSL connection: 512k/128k

	Operating system	Processor	RAM	Browser & version
10 x	XP	P 4	256	IE 6
20 x	W 98 SE	P 2	64	IE 5.5

McAuley Catholic Central School: Tumut

Bandwidth: ADSL Connection 512k/128k

	Operating system	Processor	RAM	Browser & version
15 x	XP	P 4	256	IE 6

St Mary's War Memorial School: West Wyalong

Bandwidth: Satellite Connection 220k/33k

	Operating system	Processor	RAM	Browser & version
5 x	XP	P 4	256	IE 6
2 x	W 98 SE	P 2	128	IE 5.5
2 x	W 98 SE	P 1	64	IE 6.0

Melbourne Archdiocese: Primary schools

St Mary's, Werribee
Bandwidth: 64K ISDN

	Operating system	Processor	RAM	Browser & version
Computer 1	Windows 98	Pentium III	256Mb	Internet Explorer 5.2
Computer 2	Windows 98	Pentium I	64Mb	Internet Explorer 5.2

St Mark's, Dingley
Bandwidth: 128K ISDN

	Operating system	Processor	RAM	Browser & version
Computer 1	Windows 98	Celeron 333Mhz	64 Mb	Internet Explorer 6
Computer 2	Windows 98	Celeron 500Mhz	128Mb	Internet Explorer 6
Computer 3	Windows 98	Celeron 1.3 Ghz	128Mb	Internet Explorer 6
Computer 4	Windows 98	Pentium III 800 Mhz	128Mb	Internet Explorer 6
Computer 5	Windows 98	Pentium IV 2 Ghz	256Mb	Internet Explorer 6

St Monica's Footscray
Bandwidth: 64-256K ADSL

	Operating system	Processor	RAM	Browser & version
Computer 1	Windows 98	Celeron 500Mhz	192Mb	Internet Explorer 6
Computer 2	Windows 98	Celeron 500Mhz	192Mb	Internet Explorer 6
Computer 3	OSX 9.2.2.	Mac	128Mb	Internet Explorer 5.1
Computer 4	OSX 9.2.2.	Mac	128Mb	Internet Explorer 5.1
Computer 5	OSX9.0.4	Mac 233 Mhz	96Mb	Internet Explorer 5.2

St PiusX, Heidelberg

Bandwidth: 64-256K ADSL

	Operating system	Processor	RAM	Browser & version
Computer 1	OSXv10	iBook 500 Mhz Power G3 (laptop)	128Mb	Internet Explorer 5.2
Computer 2	OSXv10	Imac 700 Mhz Power G3	128Mb	Internet Explorer 5.2

St Vincent de Paul
Bandwidth: 256K –1.5Mg ADSL

	Operating system	Processor	RAM	Browser & version
Computer 1	Win XP	Pentium IV	128Mb	Internet Explorer 6
Computer 2	Win 98 2nd edition	Celeron	128Mb	Internet Explorer 6
Computer 3	Win 98 2nd edition	Travelmate laptop	128Mb	Internet Explorer 6
Computer 4	OSXv10	Power PC G4	256Mg	Internet Explorer 6
Computer 5	Win 98 2nd edition	Pentium II	64Mb	Internet Explorer 6
Computer 6	Win 98 2nd edition	700 Mhz laptop	128Mb	Internet Explorer 6

Melbourne Archdiocese: Secondary schools

Avila College, Mt Waverley
Bandwidth: 256K –1.5Mg ADSL

	Operating system	Processor	RAM	Browser & version
Computer 1	Win 95	Celeron 400	64Mb	Internet Explorer 5.5
Computer 2	Win XP	Pentium	512Mb	Internet Explorer 6
Computer lab (25 computers)	Win ME	Celeron 400	64Mb	Internet Explorer 5.5

St Paul's College, Altona
Bandwidth: 1024 DAR

	Operating system	Processor	RAM	Browser & version
Computer 1	Win ME	Celeron (Pentium 100)	60Mb	Internet Explorer 5.5
Computer 2	Win ME	Celeron	48Mb	Internet Explorer 5.5
Computer lab (25 computers)	Win ME	Celeron	48Mb	Internet Explorer 5.5

Northern Territory

The following computers were used to trial the learning objects from the CD ROM. The telecommunications to these schools is poor - hence the CD ROM trial

Ltyentye Apurte

	Operating system	Processor	RAM	Browser & version
Computer 1 (LATIS)	Windows Professional 2000	Pentium II	63 OMB	Internet Explorer 6
Computer 2 (IDL)	Windows Professional 2000	Intel (R) Pentium (R) 4CPU 2.66GHZ	515, 568 Kb	Internet Explorer Broadcom Net X Treme gigabit ethernet

Our Lady of the Sacred Heart School

	Operating system	Processor	RAM	Browser & version
Computer 1 (Home computer)	Windows 2000	IBM	N/A	N/A

Bathurst Island: Murrupurtiyanuwu and St Francis Xavier School

Computers in both schools on Bathurst Island use Dell computers. The trial was conducted on one standalone computer:

	Operating system	Processor	RAM	Browser & version
Computer 1	Microsoft Windows XP	Intel Pentium II	128MB	Internet Explorer 6

15 APPENDIX SEVEN

BELTS teacher user manual developed by the Melbourne Archdiocese for the trial.

elearning

BELTS

Basic eLearning Tool Set

An Introduction to Belts

elearning

What is Belts?

Belts (Basic elearning Tool Set) is software that has been developed by the Le@rning Federation to enable education systems access for the purpose of trialling and testing learning objects.

A Learning Object is defined (by The Le@rning Federation) as:
"one or more files designed to be used as a standalone learning experience – a 'chunk' of material (which might consist of audio, graphic, text, animation or some relevant mix of these components) that will make sense to the learner by itself. ……Learning objects can, of course, be used as components of learning sequences or treatments of topics, or as elements of units of study. ….Teachers can construct their own sequences as they wish, making their own decisions about what will work for their students as a whole group, as small groups or as individual learners, in their own contexts."

So what does eLearning mean? E-learning is defined as learning with the aid of information and communications technology tools. These may include the Internet, intranets, computer-based technology, or interactive television. They may also include the use of e-technology to support traditional methods of learning, for example using electronic whiteboards or video conferencing.

E-learning is relatively new. It can be customised to the need of the individual and has the flexibility to allow studying at a pace, time and location that best suits the student. It gives the potential to provide widespread access to high quality, relevant training and education.

The use of Belts is being piloted in a number of schools. The focus of the pilot is to gauge the professional development requirements of teachers so that they will be able to make best use of the resources available to them. Information gathered during the pilot will help shape professional development sessions, based on the ways in which the objects are used, teacher feedback, technical support issues and so on. **An extra focus for this second stage is to measure the impact of the program on school servers thereby providing vital information for future directions.**

The training material for teachers is designed to provide an introduction to lesson preparation in Belts and a basic understanding of the concept and uses of classes.

1. Login and getting started
2. Create a Lesson
3. Edit a lesson

LOGIN AND GETTING STARTED

Your login has been created for a '**teacher**' user, and consists of a username and password. As a teacher user, you are able to find resources, prepare lessons and manage classes.

There are several other types of users – system administrator, content manager and student. Each one has different access rights with different functions and information available on screen.

Besides user logins, there are lesson logins. A lesson login requires a lesson id and a password. These will be explained in more detail later.

☛ At the computer, start Internet Explorer or Netscape. In the address line, type in the Belts address:

http://belts.ceo.melb.catholic.edu.au

You should see the home page for the Belts web site:

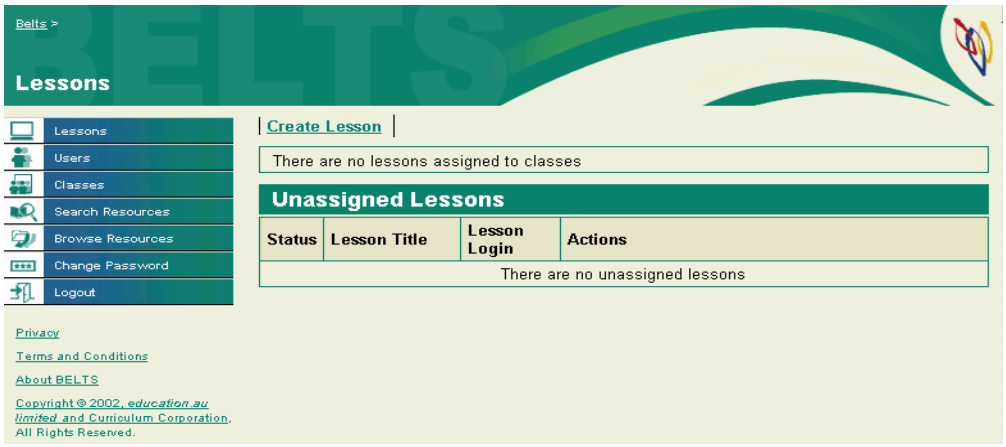
☛ **Type** in your username and password in the relevant boxes. Then click on the Login button:

This will take you to the Belts main page. It provides all the menu options or buttons that a teacher has access to on the site. Other users will see slightly different menu choices.

The **main** page:

☛ **Click** on the button.

The **Lesson Page** will be displayed.

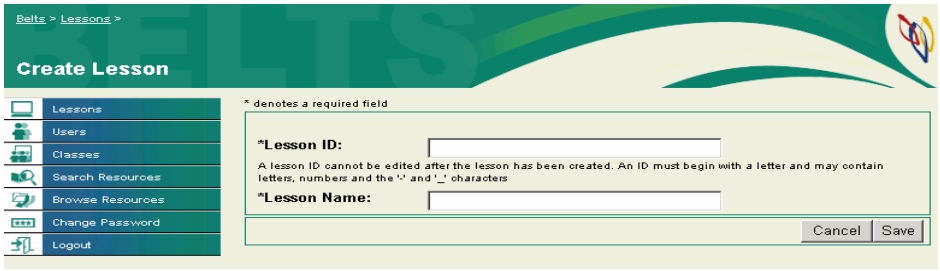


- This lists the lessons that the particular teacher owns.
- It also lists lessons that other teachers have shared with this teacher.
- This teacher has no lessons currently.

CREATE A LESSON

☛ **Click** on the **Create Lesson** link.

The **Create Lesson** page will be displayed.



In order to create a lesson, it must be given a unique **Lesson ID** and a **Lesson name**. This must be done before the lesson contents can be prepared.

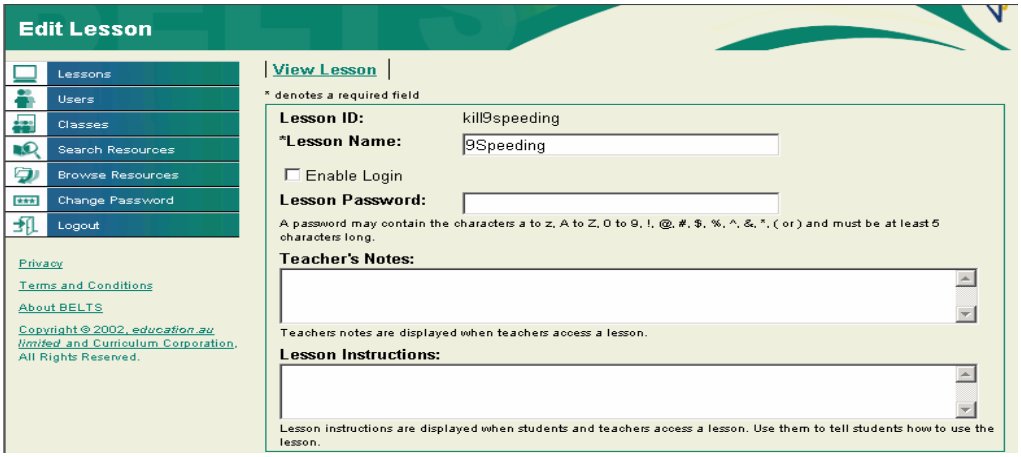
- Once a lesson has been created with a lesson ID, the Lesson ID can be used at the login page to access the lesson, rather than a username.

☛ **Type** in a unique identifier for the Lesson ID.

☛ **Type** in a meaningful title for the Lesson name .

☛ **Click** on the Save button.

The **Edit Lesson** page will be displayed.


Edit Lesson
Lessons
Users
Classes
Search Resources
Browse Resources
Change Password
Logout
Privacy
Terms and Conditions
About BELTS
Copyright © 2002, education.au limited and Curriculum Corporation. All Rights Reserved.
View Lesson
* denotes a required field
Lesson ID: kill9speeding
*Lesson Name: 9Speeding
Enable Login
Lesson Password:
A password may contain the characters a to z, A to Z, 0 to 9, !, @, #, $, %, ^, &, *, (or) and must be at least 5 characters long.
Teacher's Notes:
Teachers notes are displayed when teachers access a lesson.
Lesson Instructions:
Lesson instructions are displayed when students and teachers access a lesson. Use them to tell students how to use the lesson.

This page has a number of fields used to enter and store information about the lesson that is being prepared.

EDIT A LESSON

The first part of the **Edit Lesson** page is used to:

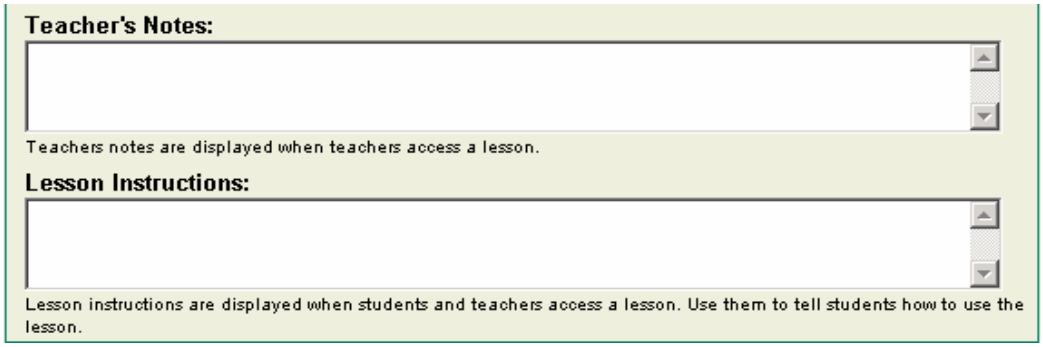
- allow lesson login to be used
  - assemble teacher notes about the lesson
  - provide instructions for the lesson.

☛ **Click** on the **Enable Login** box so that it is ticked.

By ticking the box, this allows a lesson login to be used (rathe rather than a user login). A Lesson password must be specified to complete the lesson login process.

☛ **Type** a password into the Lesson Password field. Make it something that will be easy to remember.

First part of the **Edit Lesson** page:


Teacher's Notes:
Teachers notes are displayed when teachers access a lesson.
Lesson Instructions:
Lesson instructions are displayed when students and teachers access a lesson. Use them to tell students how to use the lesson.

☛ In the **Teacher Notes** field, **type** in a description of the lesson.

For example, “This lesson investigates the braking efficiency of cars and trucks by testing stopping distances under controlled conditions. Factors include vehicle type, road surface type, weather conditions, and tyre tread.”

This information is visible only to be the teacher who creates the lesson and to other teachers who are able to share the lesson. It can be used as a reminder/reference point for the teacher.

☛ In the **Lesson Instructions** field, **type** in an outline of the lesson.

“Prior to completing this lesson, students should read Chapter 9 of their text book. This lesson looks at the factors affecting braking. After completing this lesson, students need to complete the **9Speeding** worksheet in Lesson Content.”

This information is displayed to the student prior to them accessing the content inside the lesson.

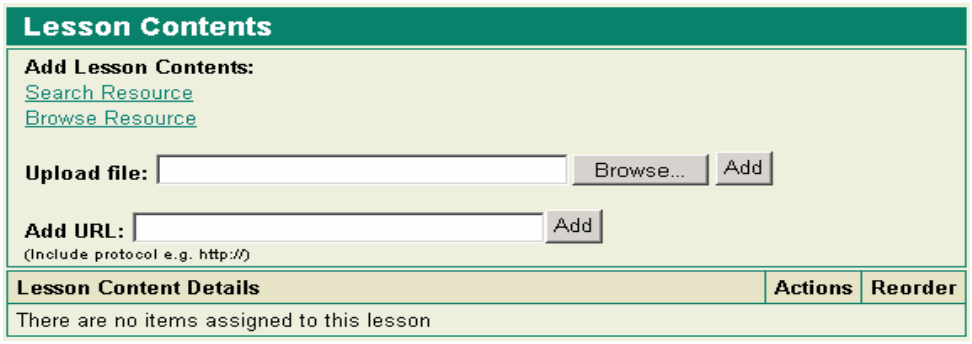
☛ **Click** on the Save button. *You must do this before proceeding to the next steps in creating a lesson, otherwise your work will be lost.*

The second part of the **Edit Lesson** page is used to:

- Select the digital content that will be used in the lesson
- Add any of the teacher's own files, eg a worksheets
- Add other online resources using web page addresses.

Scroll further down the Edit Lesson page.

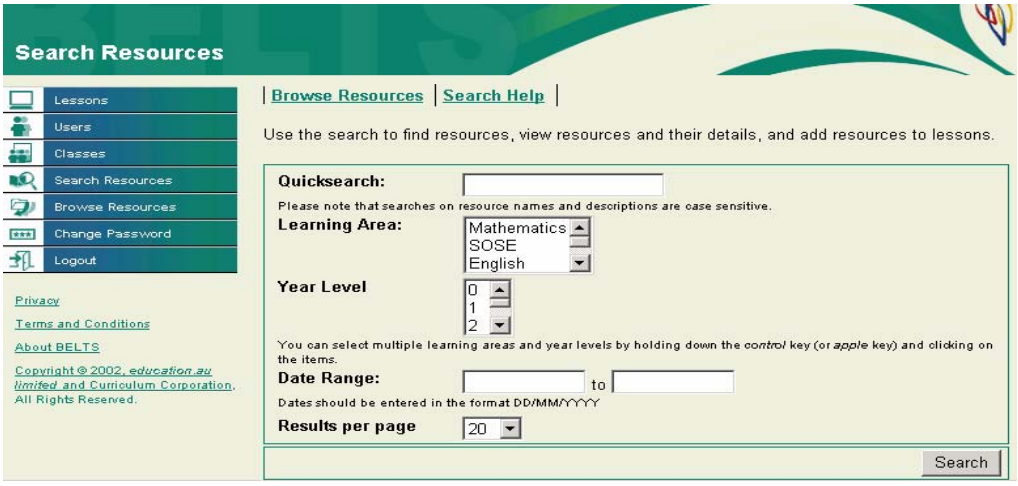
Second part of the **Edit Lesson** page.



☛ **Click** on the **Search Resource** link.

This will display the Search Resources page which allows you to find the learning objects available to your school.

The **Search Resources** page:



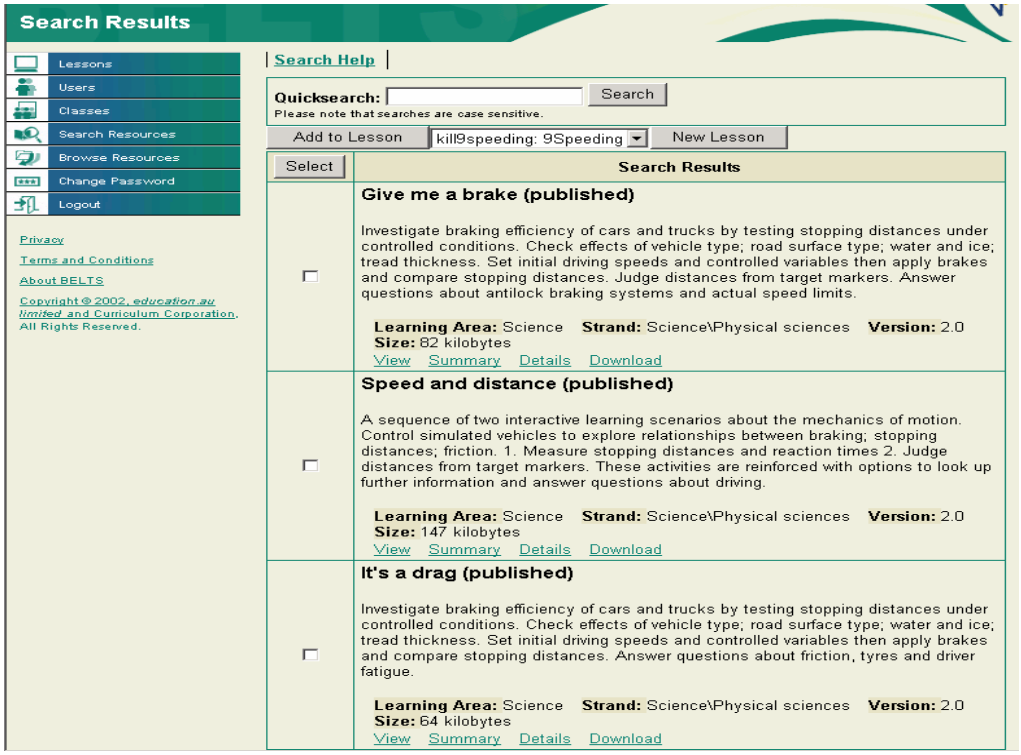
This page allows you to search for learning objects across a range of criteria.

☛ In the **Quicksearch** field, type in **braking**.

☛ **Click** on the Search button.

Note that the **Quicksearch** field is case sensitive. This means using a capital and lower case letter to find the learning object.

The **Search Results** page


Search Results
Lessons
Users
Classes
Search Resources
Browse Resources
Change Password
Logout
Privacy
Terms and Conditions
About BELTS
Copyright © 2002, education.au limited and Curriculum Corporation. All Rights Reserved.
Search Help
Quicksearch:
Search
Please note that searches are case sensitive.
Add to Lesson
kill9speeding: 9Speeding
New Lesson
Select
Search Results
Give me a brake (published)
Investigate braking efficiency of cars and trucks by testing stopping distances under controlled conditions. Check effects of vehicle type; road surface type; water and ice; tread thickness. Set initial driving speeds and controlled variables then apply brakes and compare stopping distances. Judge distances from target markers. Answer questions about antilock braking systems and actual speed limits.
Learning Area: Science Strand: Science\Physical sciences Version: 2.0
Size: 82 kilobytes
View Summary Details Download
Speed and distance (published)
A sequence of two interactive learning scenarios about the mechanics of motion. Control simulated vehicles to explore relationships between braking; stopping distances; friction. 1. Measure stopping distances and reaction times 2. Judge distances from target markers. These activities are reinforced with options to look up further information and answer questions about driving.
Learning Area: Science Strand: Science\Physical sciences Version: 2.0
Size: 147 kilobytes
View Summary Details Download
It's a drag (published)
Investigate braking efficiency of cars and trucks by testing stopping distances under controlled conditions. Check effects of vehicle type; road surface type; water and ice; tread thickness. Set initial driving speeds and controlled variables then apply brakes and compare stopping distances. Answer questions about friction, tyres and driver fatigue.
Learning Area: Science Strand: Science\Physical sciences Version: 2.0
Size: 64 kilobytes
View Summary Details Download

A number of learning objects should appear on the screen.

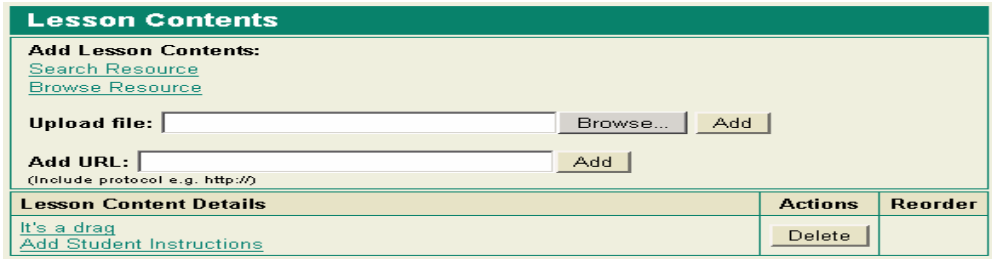
☛ **Scroll** down until you find "**It's a drag**".

☛ **Click** on the tick box next to "It's a drag".

☛ **Check** the correct lesson name is showing under the Quicksearch field.

☛ **Click** on the Add to Lesson button.

The **Edit Lesson** page is redisplayed.



The learning object **It's a drag**, is now listed in the **Lesson Content Details**.

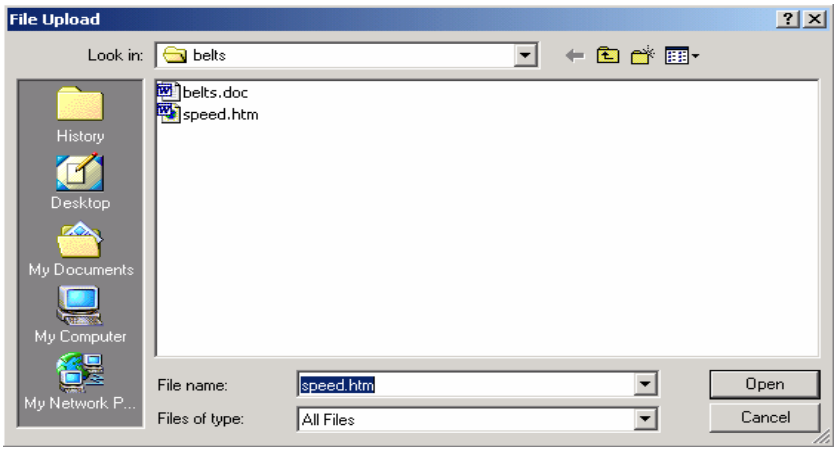
It is possible to upload files that could be included in this lesson.

For example, a teacher could have worksheets or student activity sheets saved on the school computer or network. These files can be uploaded and be used as part of the lesson.

☛ **Click** on the button to locate file to upload to the lesson.

Note that this is using the **Browse** button, not the Browse Resources link.

The File Upload window appears:

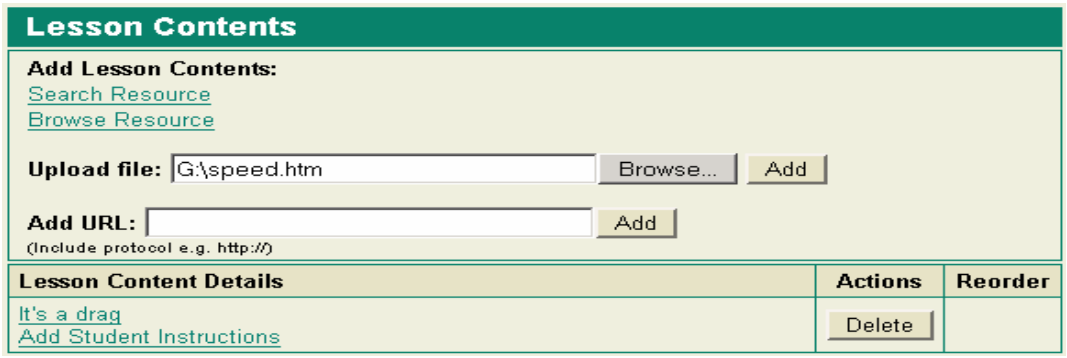


A new window opens which shows the file and folders for this computer or network. This enables finding of the file which is to be uploaded.

This example finds a student worksheet called "Speed.htm".

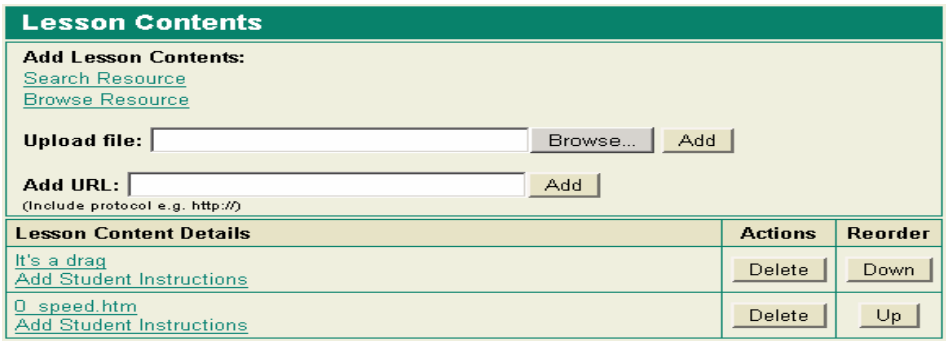
☛ **Click** on the button.

The **Edit Lesson** page is redisplayed again.



Click on the button to include the file in the **Lesson Content Details**.

The **Edit Lesson** page is redisplayed with the file listed.



Repeat the above steps to add another file to the lesson.

When more than one file is listed in the Lesson Content Details, the **Up** & **Down** buttons can be used to move contents to a different order in the list.

It is also possible to add URLs or web site addresses to the **Lesson Content Details.**

For example, a teacher could have a number of web sites which provide useful online resources or information or activities for students. These URLs can be uploaded and be used as part of the lesson.

- ☛ **Open** another copy of Internet Explorer or Netscape.
- ☛ **Type** in the address of the web site you wish to include in the lesson.
- ☛ **Highlight** the whole address by clicking and dragging your mouse in the Address line.
- ☛ **Press CTRL** + **C** on your keyboard to copy the web address.
- ☛ **Return** to your **Belts** – **Edit Lesson** page.

☛ **Click** in the **Add URL** field.

☛ **Press CTRL** + **V** on your keyboard to paste the web address into this field.

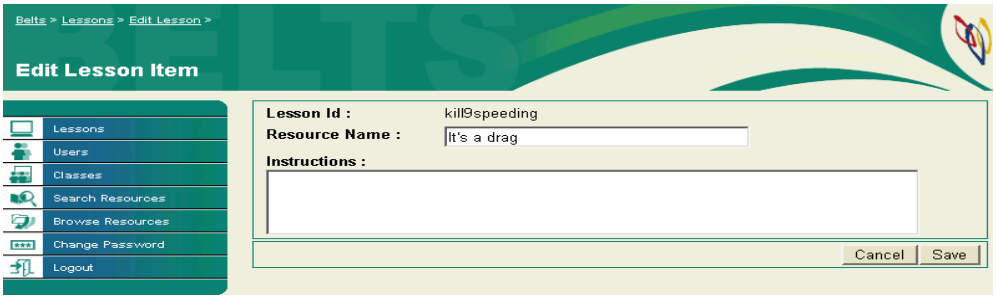
☛ **Click** on the Add button to include the URL in the **Lesson Content Details**.

Lesson Content Details	Actions	Reorder
It's a drag Add Student Instructions	Delete	Down
0_speed.htm Add Student Instructions	Delete	Up Down
http://www.phys.virginia.edu/education/outreach/8thgradesol/compoundmachineST.htm Add Student Instructions	Delete	Up

Now that all the content has been added or included in the lesson, it is possible to add instructions abou the lesson for students.

☛ **Click** on the **Add Student Instructions** link.

The **Edit Lesson Item** page is displayed.

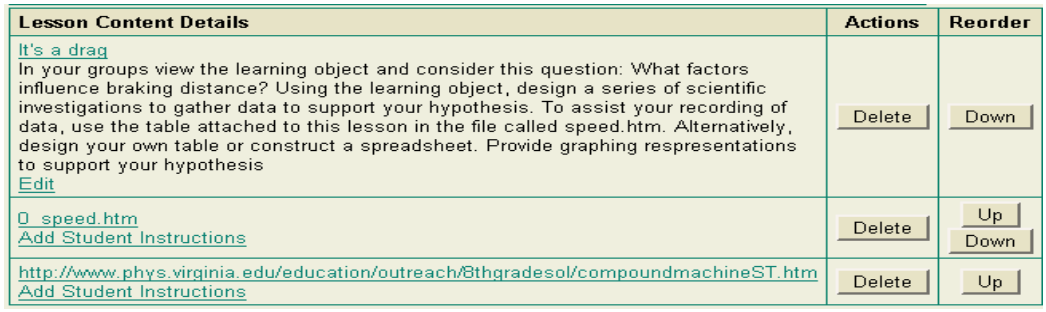


This has an input field for writing instructions about the learning object titled "**It's a drag**".

For example "In your groups, view the learning object and consider this question: What factors influence braking distance? Using the learning object, design a series of scientific investigations to gather data to support your hypothesis. To assist your recording of data, use the table attached to this lesson in the file called speed.htm. Alternatively, design your own table or construct a spreadsheet. Provide graphing respresentations to support your hypothesis."

☛ **Click** on Save button.

The **Edit Lesson** page is redisplayed. It shows the instructions for this lesson under the learning objected in the **Lesson Content Details** area.



Lesson Content Details	Actions	Reorder
It's a drag In your groups view the learning object and consider this question: What factors influence braking distance? Using the learning object, design a series of scientific investigations to gather data to support your hypothesis. To assist your recording of data, use the table attached to this lesson in the file called speed.htm. Alternatively, design your own table or construct a spreadsheet. Provide graphing respresentations to support your hypothesis Edit	Delete	Down
0_speed.htm Add Student Instructions	Delete	Up Down
http://www.phys.virginia.edu/education/outreach/8thgradesol/compoundmachineST.htm Add Student Instructions	Delete	Up

As stated on page 3, there are 2 different ways to login and view a learning object:

A **Using the Lesson ID and password** (as outlined on page 5 of these instructions)

OR

B **Assigning a class to the lesson**

Below are the instructions for assigning a class to the lesson, as A has already been covered on page 5.